# ESTIMATED USE OF WATER IN THE UNITED STATES IN 1◇9◇9◇0


U.S. Geological Survey Circular 1081


Water-resources regions of the United States as established by the U.S. Water Resources Council in 1970. This map shows the relation of the regions to the States.
See glossary in this report for definitions of water-resources region.

# ESTIMATED USE OF WATER IN THE UNITED STATES IN 1990

By Wayne B. Solley, Robert R. Pierce, and Howard A. Perlman

U.S. GEOLOGICAL SURVEY CIRCULAR 1081

**U. S. DEPARTMENT OF THE INTERIOR**

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# GLOSSARY

Water-use terminology is continuing to expand in this series of water-use circulars prepared at 5-year intervals. The term "water use" as initially used in 1950 in the U.S. Geological Survey's water-use circulars meant withdrawals of water; in the report for 1960, the term was redefined to include consumptive use of water as well as withdrawals. With the beginning of the Survey's National Water-Use Information Program in 1978 the term was again redefined to include return flow and offstream and instream uses. In the report for 1985, the term was redefined to include withdrawals plus deliveries.

## TERMS USED IN THIS REPORT

**acre-foot (acre-ft)**—the volume of water required to cover 1 acre of land (43,560 square feet) to a depth of 1 foot.

**animal specialties**—water use associated with the production of fish in captivity except fish hatcheries, fur-bearing animals in captivity, horses, rabbits, and pets. *See also* livestock water use.

**aquaculture**—farming of organisms that live in water, such as fish, shellfish, and algae.

**aquifer**—a geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs.

**commercial water use**—water for motels, hotels, restaurants, office buildings, other commercial facilities, and institutions. The water may be obtained from a public supply or may be self supplied. *See also* public supply and self- supplied water.

**consumptive use**—that part of water withdrawn that is evaporated, transpired, incorporated into products or crops, consumed by humans or livestock, or otherwise removed from the immediate water environment. Also referred to as water consumed.

**conveyance loss**—water that is lost in transit from a pipe, canal, conduit, or ditch by leakage or evaporation. Generally, the water is not available for further use; however, leakage from an irrigation ditch, for example, may percolate to a ground-water source and be available for further use.

**cooling water**—water used for cooling purposes, such as of condensers and nuclear reactors.

**delivery/release**—the amount of water delivered to the point of use and the amount released after use; the difference between these amounts is usually the same as the consumptive use. *See also* consumptive use.

**domestic water use**—water for household purposes, such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, and watering lawns and gardens. Also called residential water use. The water may be obtained from a public supply or may be self supplied. *See also* public supply and self-supplied water.

**evaporation**—process by which water is changed from a liquid into a vapor. *See also* evapotranspiration and transpiration.

**evapotranspiration**—a collective term that includes water discharged to the atmosphere as a result of evaporation from the soil and surface-water bodies and as a result of plant transpiration. *See* also evaporation and transpiration.

**freshwater**—water that contains less than 1,000 milligrams per liter (mg/L) of dissolved solids; generally, more than 500 mg/L of dissolved solids is undesirable for drinking and many industrial uses.

**ground water**—generally all subsurface water as distinct from surface water; specifically, that part of the subsurface water in the saturated zone (a zone in which all voids are filled with water) where the water is under pressure greater than atmospheric.

**hydroelectric power water use**—the use of water in the generation of electricity at plants where the turbine generators are driven by falling water. Hydroelectric water use is classified as an instream use in this report.

**in-channel use**—*see* instream use.

**industrial water use**—water used for industrial purposes such as fabrication, processing, washing, and cooling, and includes such industries as steel, chemical and allied products, paper and allied products, mining, and petroleum refining. The water may be obtained from a public supply or may be self supplied. *See also* public supply and self- supplied water.

**instream use**—water that is used, but not withdrawn, from a ground- or surface-water source for such purposes as hydroelectric power generation, navigation, water-quality improvement, fish propagation, and recreation. Sometimes called nonwithdrawal use or in-channel use.

**irrigation district**—a cooperative, self-governing public corporation set up as a subdivision of the State government, with definite geographic boundaries, organized and having taxing power to obtain and distribute water for irrigation of lands within the district; created under the authority of a State legislature with the consent of a designated fraction of the landowners or citizens.

**irrigation water use**—artificial application of water on lands to assist in the growing of crops and pastures or to maintain vegetative growth in recreational lands such as parks and golf courses.

**kilowatthour (kWh)**—a unit of energy equivalent to one thousand watthours.

**livestock water use**—water for livestock watering, feed lots, dairy operations, fish farming, and other on-farm needs. Livestock as used here includes cattle, sheep, goats, hogs, and poultry. Also included are animal specialties. *See* also rural water use and animal specialties water use.

**million gallons per day (Mgal/d)**—a rate of flow of water.

**mining water use**—water use for the extraction of minerals occurring naturally including solids, such as coal and ores; liquids, such as crude petroleum; and gases, such as natural gas. Also includes uses associated with quarrying, well operations (dewatering), milling (crushing, screening, washing, floatation, and so forth), and other preparations customarily done at the mine site or as part of a mining activity. Does not include water used in processing, such as smelting, refining petroleum, or slurry pipeline operations. These uses are included in industrial water use.

**offstream use**—water withdrawn or diverted from a ground- or surface-water source for public-water supply, industry, irrigation, livestock, thermoelectric power generation, and other uses. Sometimes called off-channel use or withdrawal.

**per capita use**—the average amount of water used per person during a standard time period, generally per day.

**public supply**—water withdrawn by public and private water suppliers and delivered to users. Public suppliers provide water for a variety of uses, such as domestic, commercial, thermoelectric power, industrial, and public water use. *See also* commercial water use, domestic water use, thermoelectric power water use, industrial water use, and public water use.

**public-supply deliveries**—water provided to users through a public-supply distribution system.

**public water use**—water supplied from a public-water supply and used for such purposes as firefighting, street washing, and municipal parks and swimming pools. *See also* public supply.

**reclaimed wastewater**—wastewater treatment plant effluent that has been diverted for beneficial use before it reaches a natural waterway or aquifer.

**recycled water**—water that is used more than one time before it passes back into the natural hydrologic system.

**residential water use**—*see* domestic water use.

**return flow**—the water that reaches a ground- or surface-water source after release from the point of use and thus becomes available for further use.

**reuse**—*see* recycled water.

**rural water use**—term used in previous water-use circulars to describe water used in suburban or farm areas for domestic and livestock needs. The water generally is self supplied, and includes domestic use, drinking water for livestock, and other uses, such as dairy sanitation, evaporation from stock-watering ponds, and cleaning and waste disposal. *See also* domestic water use, livestock water use, and self-supplied water.

**saline water**—water that contains more than 1,000 milligrams per liter of dissolved solids.

**self-supplied water**—water withdrawn from a surface- or ground-water source by a user rather than being obtained from a public supply.

**standard industrial classification (SIC) codes**—four- digit codes established by the Office of Management and Budget and used in the classification of establishments by type of activity in which they are engaged.

**surface water**—an open body of water, such as a stream or a lake.

**thermoelectric power water use**—water used in the process of the generation of thermoelectric power. The water may be obtained from a public supply or may be self supplied. *See* also public supply and self-supplied water.

**transpiration**—process by which water that is absorbed by plants, usually through the roots, is evaporated into the atmosphere from the plant surface. *See also* evaporation and evapotranspiration.

**wastewater**—water that carries wastes from homes, businesses, and industries.

**wastewater treatment**—the processing of wastewater for the removal or reduction of contained solids or other undesirable constituents.

**wastewater-treatment return flow**—water returned to the hydrologic system by wastewater-treatment facilities.

**water-resources region**—designated natural drainage basin or hydrologic area that contains either the drainage area of a major river or the combined drainage areas of two or more rivers; of 21 regions, 18 are in the conterminous United States, and one each are in Alaska, Hawaii, and the Caribbean. (*See* map on inside of front cover.)

**water-resources subregion**—the 21 designated water-resources regions of the United States are subdivided into 222 subregions. Each subregion includes that area drained by a river system, a reach of a river and its tributaries in that reach, a closed basin(s), or a group of streams forming a coastal drainage system.

**water transfer**—artificial conveyance of water from one area to another.

**water use**—1) in a restrictive sense, the term refers to water that is actually used for a specific purpose, such as for domestic use, irrigation, or industrial processing. In this report, the quantity of water use for a specific category is the combination of self-supplied withdrawals and public-supply deliveries. 2) More broadly, water use pertains to human's interaction with and influence on the hydrologic cycle, and includes elements such as water withdrawal, delivery, consumptive use, wastewater release, reclaimed wastewater, return flow, and instream use. *See also* offstream use and instream use.

**watthour (Wh)**—an electrical energy unit of measure equal to one watt of power supplied to, or taken from, an electrical circuit steadily for one hour.

**withdrawal**—water removed from the ground or diverted from a surface-water source for use. *See also* offstream use and self-supplied water.

## CONVERSION FACTORS

| Multiply | By | To Obtain |
|---|---|---|
| | **Area** | |
| acre | 43,560 | square foot ($ft^2$) |
| | 4,047 | square meter ($m^2$) |
| | 0.001562 | square mile ($mi^2$) |
| | **Flow** | |
| gallon per day (gal/d) | 3.785 | liter per day |
| million gallons per day (Mgal/d) | 1.121 | thousand acre-feet per year |
| | 0.001547 | thousand cubic feet per second |
| | 0.6944 | thousand gallons per minute |
| | 0.003785 | million cubic meters per day |
| | 1.3815 | million cubic meters per year |
| thousand acre-feet per year | 0.8921 | million gallons per day |
| | 0.001380 | thousand cubic feet per second |
| | 0.6195 | thousand gallons per minute |
| | 0.003377 | million cubic meters per day |

**Some water relations in inch-pounds units are listed below:**

| | | (Approximations) |
|---|---|---|
| 1 gallon | = | 8.34 pounds |
| 1 million gallons | = | 3.07 acre-feet |
| 1 cubic foot | = | 62.4 pounds |
| | = | 7.48 gallons |
| 1 acre-foot (acre-ft) | = | 325,851 gallons |
| | = | 43,560 cubic feet |
| 1 inch of rain | = | 17.4 million gallons per square mile |
| | = | 27,200 gallons per acre |
| | = | 100 tons per acre |

# ESTIMATED USE OF WATER IN THE UNITED STATES IN 1990

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ABSTRACT

Water withdrawals in the United States during 1990 were estimated to average 408,000 million gallons per day (Mgal/d) of freshwater and saline water for offstream uses—2 percent more than the 1985 estimate. Total freshwater withdrawals were an estimated 339,000 Mgal/d during 1990, about the same as during 1985. Average per-capita use for all offstream uses was 1,620 gallons per day (gal/d) of freshwater and saline water combined and 1,340 gal/d of freshwater.

Offstream water-use categories are classified in this report as public supply, domestic, commercial, irrigation, livestock, industrial, mining, and thermoelectric power. During 1990, public-supply withdrawals were an estimated 38,500 Mgal/d, and self-supplied withdrawals were estimated as follows: domestic, 3,390 Mgal/d; commercial, 2,390 Mgal/d; irrigation, 137,000 Mgal/d; livestock, 4,500 Mgal/d; industrial, 22,600 Mgal/d, of which 3,270 Mgal/d was saline water; mining, 4,960 Mgal/d, of which 1,650 Mgal/d was saline; and thermoelectric power, 195,000 Mgal/d, of which 64,500 Mgal/d was saline.

Water use for hydroelectric power generation, the only instream use compiled in this report, was estimated to be 3,290,000 Mgal/d during 1990, or 8 percent more than during 1985 and about the same as estimated for 1975 and 1980.

Estimates of withdrawals by source indicate that during 1990, total surface-water withdrawals were 327,000 Mgal/d, or 1 percent more than during 1985, and total ground-water withdrawals were 80,600 Mgal/d, or 9 percent more than during 1985. Total saline-water withdrawals during 1990 were 69,400 Mgal/d, or 15 percent more than during 1985, most of which was saline surface water. Reclaimed wastewater averaged about 750 Mgal/d during 1990, or 30 percent more than during 1985.

Total freshwater consumptive use was an estimated 94,000 Mgal/d during 1990, or 2 percent more than during 1985. Consumptive use by irrigation accounted for the largest part of total consumptive use, and was an estimated 76,200 Mgal/d. Freshwater consumptive use in the East (water-resources regions east of and including the Mississippi regions) was about 12 percent of freshwater withdrawn in the East and accounted for only 21 percent of the Nation's total consumptive use. By comparison, freshwater consumptive use in the West was about 44 percent of the freshwater withdrawn in the West.

The 1990 estimates of total freshwater withdrawals and consumptive use were just slightly more than the 1985 estimates but substantially less than the 1980 estimates; this is consistent with the general trend indicated by a slackening in the rate of increase of total withdrawals from 1970 to 1975 and again from 1975 to 1980, and a decrease in total withdrawals from 1980 to 1985. Public-supply withdrawals during 1990 were 5 percent more than during 1985, and self-supplied withdrawals during 1990 compared to 1985 were as follows: domestic, 2 percent more; commercial, 95 percent more; irrigation, 0.3 percent less; livestock, 0.8 percent more; industrial, 13 percent less; mining, 44 percent more; and thermoelectric power, 4 percent more.

A comparison of total withdrawals (fresh, saline) by State indicates that 20 States and the District of Columbia had less water withdrawn for offstream uses during 1990 than during 1985. California accounted for the most water withdrawn for offstream use, 46,800 Mgal/d, more than the total of water withdrawn in both Texas or Idaho, the next largest users. A similar comparison by water-resources regions indicates that the coastal regions (New England, Mid Atlantic, South Atlantic-Gulf, Pacific Northwest, California) accounted for nearly one-half of the total water withdrawn in the United States. Total withdrawals in the East accounted for 54 percent of the Nation's total withdrawals, the same as during 1985.

# INTRODUCTION

Water management in the United States has traditionally focused on manipulating the country's abundant supplies of freshwater to meet the needs of users. This "supply management" approach has resulted in the building of large dams and conveyance systems, especially in the West. Increasing development costs, capital shortages, government fiscal restraint, diminishing sources of water supply, polluted water, and a growing concern for the environment have forced water managers and planners to begin to rethink traditional approaches to management and to experiment with new ones. Experts on the subject of water (supply and demand) in the western United States agree that the area is in transition from the era of water-supply development to an era of water-demand management and conservation, (Wilkinson, 1985). Quantitative assessments derived from the type of national compilation contained in this report can be used to evaluate the effectiveness of alternative water-management policies and conservation activities.

## PURPOSE AND SCOPE

The purpose of this report is to present consistent and current water-use estimates by State and water-resources region for the United States, Puerto Rico, the U.S. Virgin Islands, and the District of Columbia. Estimates of water withdrawn from surface- and ground-water sources, estimates of consumptive use, and estimates of instream use and wastewater releases during 1990 are presented in this report. The U.S. Geological Survey has compiled similar national estimates every 5 years since 1950 (MacKichan, 1951, 1957; MacKichan and Kammerer, 1961; Murray, 1968; Murray and Reeves, 1972, 1977; and Solley and others, 1983,1988). This series of reports can be used to develop and evaluate trends in water use and to plan for more effective uses of the Nation's water resources in the future.

This report discusses eight categories of offstream water use—public supply, domestic, commercial, irrigation, livestock, industrial, mining, and thermoelectric power—and one category of instream use: hydroelectric power. Detailed information for other instream uses, such as navigation, recreation, pollution abatement, and fish habitat, is beyond the scope of this report. Information on wastewater-treatment facilities is given in the "Wastewater Release" section.

Information on many of the water-use categories in this report is more detailed than the information presented in previous water-use circulars in this series. For each category of offstream water use, 1990 withdrawal and consumptive-use estimates are discussed and those estimates are compared

with corresponding 1985 estimates. The text is supplemented with illustrations and tables showing data for each State, Puerto Rico, the U.S. Virgin Islands, and the District of Columbia and for each of the 21 water-resources regions. (Water-resources regions are shown on a map on the inside of the front cover.) Totals are highlighted in the tables for ease of reference. At the beginning of this report is a section on total water use by category and source of water, and at the end is a section on trends in water use for the period 1950-90.

## TERMINOLOGY

The terms and units used in this report are similar to those used in previous water-use circulars in this series. In this report, the term "offstream use" represents all water diverted or withdrawn from a surface- or ground-water source and conveyed to a place of use. "Instream use" refers to all uses taking place within the river channel itself. Hydroelectric power generation is discussed as an "instream use," although some hydroelectric power water uses could be considered as offstream use. The terms "freshwater," "saline water," and "reclaimed wastewater," as types of water, are defined in the glossary. Saline water is reported only for the industrial, mining, and thermoelectric power categories. Some public supplies treat saline water before it is distributed, but all public-supply withdrawals are considered as freshwater in this report. Surface water and ground water, as sources of water, and the categories of water use also are defined in the glossary. In this report, withdrawals refer to self-supplied withdrawals, and deliveries refer to public-supply deliveries. "Consumptive use" refers to that part of the water withdrawn that is evaporated, transpired, incorporated into products and crops, consumed by humans or livestock, or otherwise removed from the immediate water supply.

## SOURCES OF DATA AND METHODS OF ANALYSIS

In cooperation with State and local agencies, the water-use estimates for 1990 were compiled by the U.S. Geological Survey's District Offices for each county in the United States, Puerto Rico, and the U.S. Virgin Islands, and for 2,149 water-resources cataloging units. [For an explanation of cataloging units, see Seaber and others (1987)]. These estimates were entered into a State water-use data base in each District Office and submitted to the Survey's headquarters in Reston, Va. The information was aggregated by State (including Puerto Rico, the U.S. Virgin Islands, and the District of Columbia) and by the 21 water-resources regions for each

category of water use. All the water-use information compiled for this report is stored in the U.S. Geological Survey's Aggregate Water-Use Data System (AWUDS). Sources of information and accuracy of data vary and are discussed for each category in subsequent parts of this report.

More comprehensive analyses of field data and more detailed evaluations of existing water-use data were performed in the compilation of data for this report and for the 1985 water-use circular than for previous water-use circulars in this series. The increase in analyses and evaluations result from the U.S. Geological Survey's National Water-Use Information Program designed in 1978 to provide more uniform, current, and reliable information on water use. Documentation is available from each District Office that identifies the sources of water-use information for that State and describes how the water-use estimates were determined for this report. As the State water-use information programs are developed and refined, the timeliness and accuracy of water-use data at the State and national levels will continue to improve.

Two regional meetings were held during 1990 with U.S. Geological Survey and State water-use personnel to familiarize them with available sources of water-use information and preferred methodologies for data collection. Guidelines developed by the U.S. Geological Survey for preparation of State water-use estimates were distributed at those meetings. The following national data files were made available to each District for reference: U.S. Environmental Protection Agency Industrial Facilities Discharge files and Public Drinking Water Supply files, U.S. Bureau of Census population files, and the U.S. Department of Energy, Energy Information Administration reports. Each District was responsible for determining the most reliable source of information available for that State.

Water-use numerical data are the average daily quantities used. Irrigation water is applied during only a part of each year, and at variable rates; therefore, the actual rate of application is much greater than the average daily rate given in tables in this report. In this report, the numerical data generally are rounded to three significant figures for values greater than 100 and two significant figures for values less than 100. Most tables show these data in million gallons per day. Selected tables also show per-capita-use data in gallons per day, rounded to three significant figures, and irrigation and hydroelectric power data in thousand-acre feet per year. A conversion table is given after the glossary to assist those readers who may wish to convert the data to other units of measurement. All numbers were rounded independently; thus, the sums of individual rounded numbers may not equal the totals. The percentage changes discussed in the text, were calculated from the unrounded data.

Population data, which are from the U.S. Bureau of the Census population estimates and projections (U.S. Bureau of the Census, 1991), are shown

to the nearest thousand. Data on population served by public supply were compiled in cooperation with State and local agencies; these data are rounded to three significant figures.

## ACKNOWLEDGMENTS

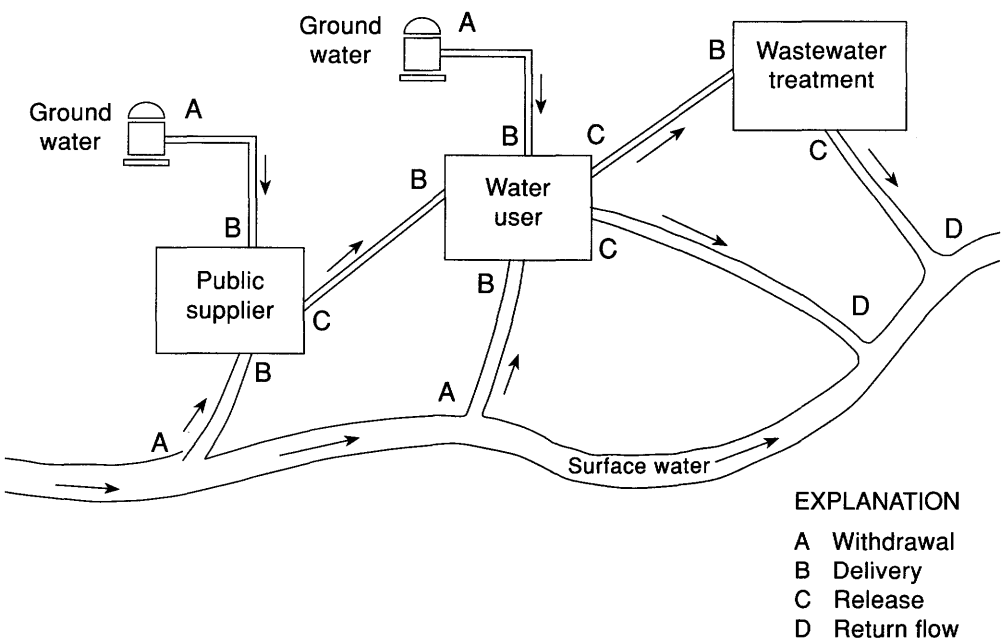
The authors acknowledge the assistance provided by the many State and local agencies that cooperated with the U.S. Geological Survey, and the many U.S. Geological Survey water-use project chiefs that participated in the collection and compilation of data for this report. Many of the States publish reports on water use as part of their participation in the National Water-Use Information Program, and a selected list of these publications is given at the end of this report.

# WATER USE

Water use in this report is subdivided into offstream use, instream use, and wastewater release. The difference among these types of use is explained below.

Offstream use is a water use that depends on water being diverted or withdrawn from a surface- or ground-water source and conveyed to the place of use. To determine the total quantity of water used (self-supplied withdrawals and public-supply deliveries), five subtypes of use are evaluated, as explained below and shown in the following sketch.

1. Withdrawal—The quantity of water diverted or withdrawn from surface- or ground-water (A in sketch).
2. Delivery/release—The quantity of water delivered at the point of use (B) and the quantity released after use (C).
3. Conveyance loss—The quantity of water that is lost in transit, for example, from point of withdrawal to point of delivery (A-B), or from point of release to point of return (C-D).
4. Consumptive use—That part of water withdrawn that is evaporated, transpired, or incorporated into products or crops. In some instances, consumptive use will be the difference between the volume of water delivered and the volume released (B-C).
5. Return flow—The quantity of water that is discharged to a surface- or ground-water source (D) after release from the point of use and thus becomes available for further use.



In this report, self-supplied withdrawals, deliveries from public suppliers (where applicable), and consumptive use estimates are given for seven categories of offstream use: domestic, commercial, irrigation, livestock, industrial, mining, and thermoelectric power. For the public-supply category, in addition to withdrawals, the report also gives water delivered to domestic, commercial, industrial, and thermoelectric power users.

Each category of use typically has different effects on the reuse potential of return flows. Reuse potential reflects the quality and the quantity of water available for subsequent use; for example, irrigation return flow may be contaminated by pesticides and fertilizers, and, because of the high consumptive use of water during irrigation, the mineral content of the return flow often is substantially greater than that of the water applied. Consequently, irrigation return flow frequently has little reuse potential. This is a significant contrast to the reuse potential of most water discharged from thermoelectric plants, where the principal change in the water is an increase in temperature.

Instream use is a water use that takes place without the water being diverted or withdrawn from surface- or ground-water sources. Examples of instream uses are hydroelectric power generation, navigation, freshwater dilution of saline estuaries, maintenance of minimum streamflow to support fish habitat, and the assimilation of wastewater.

Quantitative estimates for most instream uses are difficult to compile on a national scale. However, because such uses compete with offstream uses and affect the quality and quantity of water resources for all uses, effective water-resources management requires that methods and procedures be devised to enable instream uses to be assessed quantitatively.

The only instream-use estimates compiled for this report are for hydroelectric power generation. Unlike other instream uses, the water used for hydroelectric power generation is a measurable quantity because the amount of water passed through the plant can be documented. Consumptive use in actual hydroelectric power generation (as opposed to evaporation from impoundments created by hydroelectric dams) generally is negligible.

In this report, wastewater release refers to water released from private and public wastewater-treatment facilities. Information is provided on the number of publicly- and privately-owned wastewater-treatment facilities and on releases from only the public wastewater-treatment facilities. The releases can be either returned to the natural environment or reclaimed for beneficial uses, such as irrigation of golf courses and parks.

# OFFSTREAM USE

## Total Water Use

Total fresh and saline withdrawals during 1990 were an estimated 408,000 million gallons per day (Mgal/d) for all offstream water-use categories (public supply, domestic, commercial, irrigation, livestock, industrial, mining, thermoelectric power), or 2 percent more than the withdrawals estimated for 1985. Average per-capita use was 1,620 gallons per day (gal/d) of freshwater and saline water and 1,340 gal/d of freshwater. Total surface-water withdrawals were an estimated 327,000 Mgal/d during 1990, or 1 percent more than during 1985. About 68,200 Mgal/d of surface water withdrawn (21 percent) was saline water. Total ground-water withdrawals were an estimated 80,600 Mgal/d, or 9 percent more than during 1985. About 99 percent of groundwater withdrawn was freshwater. The use of reclaimed wastewater averaged about 750 Mgal/d, or 30 percent more than during 1985.

A comparison by water-resources region (figure 1; table 1) indicates that the coastal regions (New England, Mid Atlantic, South Atlantic-Gulf, Pacific Northwest, California) accounted for nearly one-half of the total water withdrawn in the United States. About 54 percent of the Nation's total withdrawals were in the East (water-resources regions east of and including the Mississippi regions). These regions account for about one-third of the Nation's land area.

A similar comparison of total withdrawals by State (figure 2; table 2) indicates that California accounted for the largest withdrawals, 46,800 Mgal/d, more than the total withdrawn in Texas and Idaho, the next largest users. Some 20 States and the District of Columbia had less water withdrawn for offstream uses during 1990 than during 1985.

Irrigation is the largest category of freshwater use and thermoelectric power is the largest category of freshwater and saline water use. The California and Missouri Basin water-resources regions accounted for 21 percent of total freshwater withdrawals during 1990. In these water-resources regions, 73 percent of the withdrawals were for irrigation (table 3). The State of California accounted for the most freshwater withdrawn for public supply, domestic, and irrigation, and the most saline water withdrawn for thermoelectric power (table 4). Largest surface-water withdrawals occurred in the Mid Atlantic region which is fifteenth out of twenty-one regions in land area. Of the 45,000 Mgal/d withdrawn in the Mid Atlantic region, 56 percent was saline water used for thermoelectric power plants (table 5). The State of California led the Nation in both freshwater and saline surface-water withdrawals (table 6). Five water-resources regions, the Lower Mississippi, Missouri Basin, Arkansas-White-Red, Pacific Northwest, and California, accounted for 75 percent of the nation's irrigation ground-water withdrawals (table 7). The State of California accounted for 18 percent of total ground-water withdrawals. Irrigation was the predominant use of ground water in 22 states, most located in the West (table 8).

Freshwater consumptive use in the East was about 12 percent of the freshwater withdrawn in the East and accounted for 21 percent of Nation's freshwater consumptive use (figure 3). By comparison, freshwater consumptive use in the West was about 44 percent of freshwater withdrawals. The higher consumptive use in the West is attributed to the fact that 90 percent of the total water withdrawn for irrigation occurred in the West and irrigation accounts for the largest part of consumptive use. California accounted for the largest consumptive use (figure 4).

The distribution of per-capita freshwater withdrawals by State is shown in figure 5 and table 2. High per-capita values are characteristic of thinly populated states having large acreages of irrigated land such as Idaho, Montana, and Wyoming. In contrast, figure 6 shows the intensity of freshwater withdrawals by State in million gallons per day per square mile. The smaller states in the northeast show the most intense withdrawals by area.

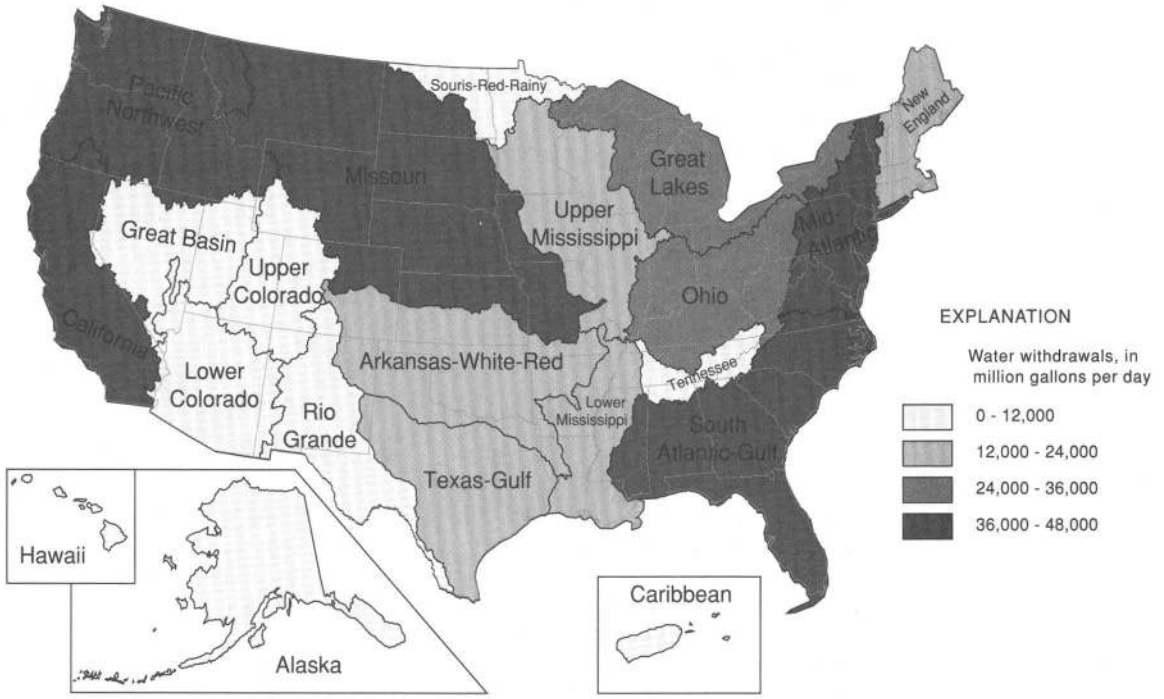



**Figure 1.** Total water withdrawals by water-resources region, 1990.

**Table 1.** Total offstream water use by water-resources region, 1990

[Figures may not add to totals because of independent rounding. Mgal/d = million gallons per day; gal/d = gallons per day]

| REGION | POPULATION, in thousands | PER CAPITA USE, freshwater, in gal/d | WITHDRAWALS, in Mgal/d (includes irrigation conveyance losses) | | | | | | | | | RECLAIMED WASTEWATER, in Mgal/d | CONVEYANCE LOSSES, in Mgal/d | CONSUMPTIVE USE, freshwater, in Mgal/d |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | By source and type | | | | | | Total | | | | | |
| | | | Ground water | | | Surface water | | | | | | | | |
| | | | Fresh | Saline | Total | Fresh | Saline | Total | Fresh | Saline | Total | | | |
| New England | 12,797 | 370 | 694 | 0.0 | 694 | 4,040 | 9,160 | 13,200 | 4,730 | 9,160 | 13,900 | 0.0 | 0.0 | 409 |
| Mid Atlantic | 41,541 | 508 | 2,640 | 1.2 | 2,640 | 18,500 | 26,500 | 45,000 | 21,100 | 26,500 | 47,600 | 63 | 2.5 | 1,260 |
| South Atlantic-Gulf | 34,732 | 962 | 7,110 | 9.1 | 7,120 | 26,300 | 10,800 | 37,100 | 33,400 | 10,800 | 44,200 | 236 | 68 | 5,140 |
| Great Lakes | 21,405 | 1,510 | 1,210 | 4.9 | 1,220 | 31,200 | 6.5 | 31,200 | 32,400 | 11 | 32,400 | 0 | 0 | 1,640 |
| Ohio | 21,882 | 1,390 | 2,650 | 22 | 2,670 | 27,800 | .6 | 27,800 | 30,400 | 22 | 30,500 | .3 | .5 | 2,110 |
| Tennessee | 3,911 | 2,350 | 305 | 0 | 305 | 8,900 | 0 | 8,900 | 9,200 | 0 | 9,200 | .4 | 0 | 321 |
| Upper Mississippi | 21,270 | 977 | 2,620 | 4.2 | 2,630 | 18,200 | 0 | 18,200 | 20,800 | 4.2 | 20,800 | 0 | .1 | 1,960 |
| Lower Mississippi | 7,167 | 2,510 | 8,340 | .6 | 8,340 | 9,630 | 1,120 | 10,800 | 18,000 | 1,120 | 19,100 | .7 | 600 | 6,970 |
| Souris-Red-Rainy | 672 | 439 | 130 | 0 | 130 | 166 | 0 | 166 | 295 | 0 | 295 | 0 | 1.1 | 144 |
| Missouri Basin | 10,048 | 3,730 | 8,490 | 37 | 8,530 | 29,000 | 0 | 29,000 | 37,500 | 37 | 37,500 | 30 | 9,010 | 12,100 |
| Arkansas-White-Red | 8,250 | 1,870 | 7,420 | 291 | 7,710 | 7,990 | 0 | 7,990 | 15,400 | 291 | 15,700 | 11 | 794 | 7,870 |
| Texas-Gulf | 15,239 | 886 | 5,480 | 400 | 5,880 | 8,020 | 4,610 | 12,600 | 13,500 | 5,010 | 18,500 | 50 | 342 | 5,910 |
| Rio Grande | 2,229 | 2,690 | 2,140 | 39 | 2,180 | 3,850 | 0 | 3,850 | 6,000 | 39 | 6,030 | 1.1 | 1,070 | 3,460 |
| Upper Colorado | 625 | 11,300 | 127 | 28 | 155 | 6,950 | 0 | 6,950 | 7,080 | 28 | 7,110 | .4 | 1,600 | 2,480 |
| Lower Colorado | 4,747 | 1,630 | 3,080 | .6 | 3,080 | 4,670 | .6 | 4,670 | 7,750 | 1.2 | 7,750 | 185 | 1,080 | 5,000 |
| Great Basin | 2,182 | 3,300 | 1,970 | 19 | 1,990 | 5,230 | 93 | 5,320 | 7,200 | 112 | 7,310 | 51 | 1,360 | 3,440 |
| Pacific Northwest | 8,912 | 4,070 | 9,780 | 0 | 9,780 | 26,500 | 36 | 26,500 | 36,300 | 36 | 36,300 | 12 | 9,670 | 12,100 |
| California | 29,442 | 1,200 | 14,400 | 310 | 14,700 | 21,000 | 11,400 | 32,400 | 35,400 | 11,700 | 47,200 | 128 | 1,750 | 20,800 |
| Alaska | 550 | 517 | 64 | 48 | 112 | 221 | 308 | 529 | 284 | 357 | 641 | 0 | .1 | 26 |
| Hawaii | 1,108 | 1,070 | 589 | .6 | 590 | 600 | 1,550 | 2,150 | 1,190 | 1,550 | 2,740 | 6.2 | 127 | 627 |
| Caribbean | 3,624 | 161 | 159 | 1.2 | 160 | 426 | 2,620 | 3,040 | 585 | 2,620 | 3,200 | 0 | 17 | 200 |
| Total | 252,336 | 1,340 | 79,400 | 1,220 | 80,600 | 259,000 | 68,200 | 327,000 | 339,000 | 69,400 | 408,000 | 750 | 27,500 | 94,000 |

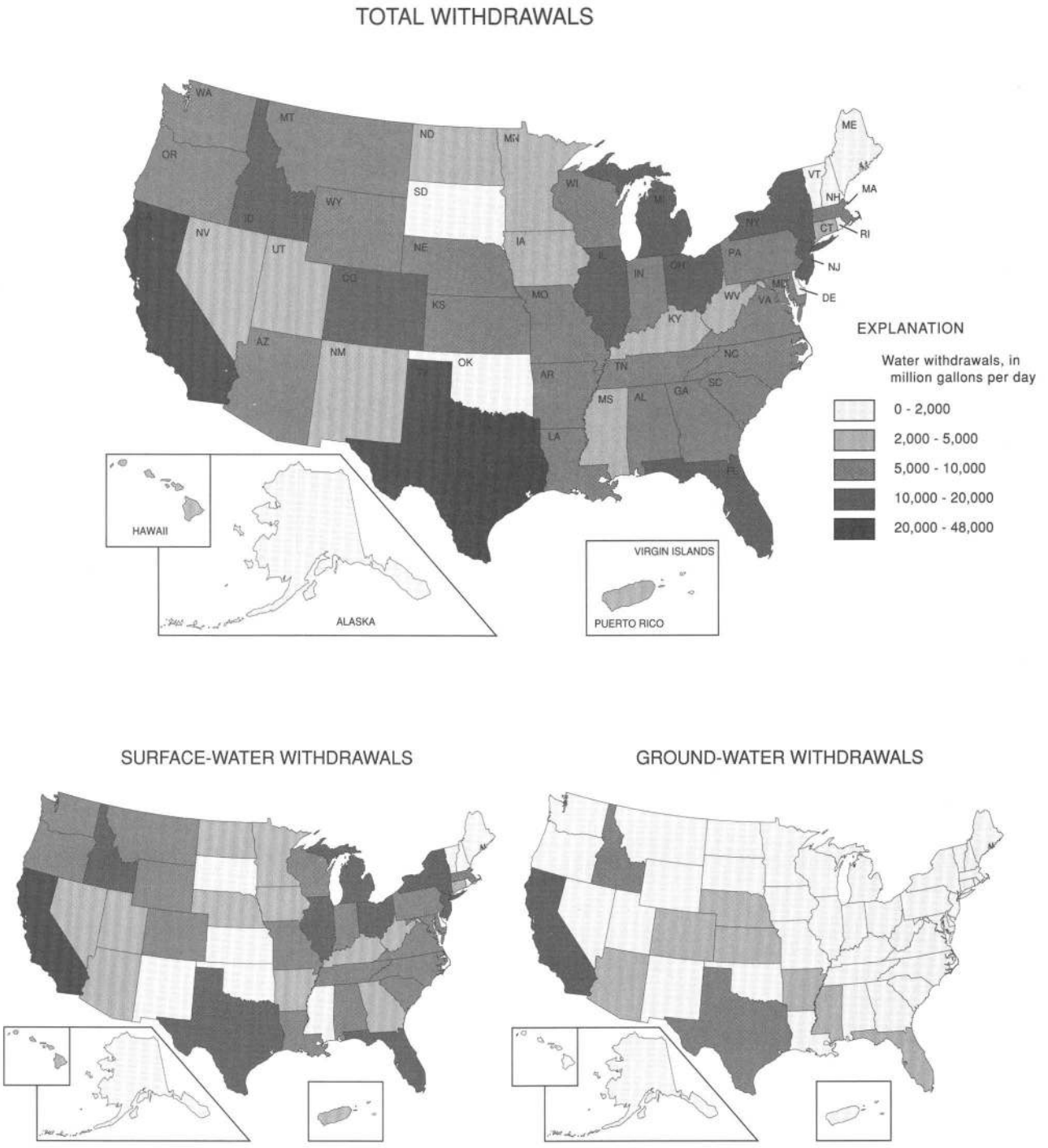



**Figure 2.** Total water withdrawals by source and State, 1990.

## Table 2. Total offstream water use by State, 1990

[Figures may not add to totals because of independent rounding. Mgal/d = million gallons per day; gal/d = gallons per day]

| STATE | POPULATION, in thousands | PER CAPITA USE, freshwater, in gal/d | WITHDRAWALS, in Mgal/d (includes irrigation conveyance losses) | | | | | | | | | RECLAIMED WASTEWATER, in Mgal/d | CONVEYANCE LOSSES, in Mgal/d | CONSUMPTIVE USE, freshwater, in Mgal/d |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | By source and type | | | | | | Total | | | | | |
| | | | Ground water | | | Surface water | | | | | | | | |
| | | | Fresh | Saline | Total | Fresh | Saline | Total | Fresh | Saline | Total | | | |
| Alabama | 4,041 | 2,000 | 394 | 9.1 | 403 | 7,680 | 0.0 | 7,680 | 8,080 | 9.1 | 8,090 | 0.0 | 0.0 | 454 |
| Alaska | 550 | 517 | 64 | 48 | 112 | 221 | 308 | 529 | 284 | 357 | 641 | 0 | .1 | 26 |
| Arizona | 3,665 | 1,790 | 2,740 | .5 | 2,740 | 3,830 | .6 | 3,830 | 6,570 | 1.2 | 6,570 | 183 | 1,010 | 4,350 |
| Arkansas | 2,353 | 3,330 | 4,710 | 0 | 4,710 | 3,130 | 0 | 3,130 | 7,840 | 0 | 7,840 | 0 | 368 | 4,140 |
| California | 29,760 | 1,180 | 14,600 | 310 | 14,900 | 20,500 | 11,400 | 31,900 | 35,100 | 11,700 | 46,800 | 133 | 1,560 | 20,900 |
| Colorado | 3,294 | 3,850 | 2,770 | 30 | 2,800 | 9,910 | 0 | 9,910 | 12,700 | 30 | 12,700 | 3.7 | 2,990 | 5,250 |
| Connecticut | 3,287 | 325 | 165 | 0 | 165 | 902 | 3,780 | 4,680 | 1,070 | 3,780 | 4,840 | 0 | 0 | 103 |
| Delaware | 666 | 1,540 | 89 | 0 | 89 | 939 | 339 | 1,280 | 1,030 | 339 | 1,370 | 0 | 0 | 59 |
| D.C. | 607 | 256 | 10 | 0 | 10 | 80 | 0 | 80 | 90 | 0 | 90 | 0 | 0 | 16 |
| Florida | 12,938 | 582 | 4,660 | 0 | 4,660 | 2,870 | 10,400 | 13,200 | 7,530 | 10,400 | 17,900 | 170 | 64 | 3,130 |
| Georgia | 6,478 | 816 | 996 | 0 | 996 | 4,290 | 65 | 4,360 | 5,290 | 65 | 5,350 | 36 | 0 | 822 |
| Hawaii | 1,108 | 1,070 | 589 | .6 | 590 | 600 | 1,550 | 2,150 | 1,190 | 1,550 | 2,740 | 6.2 | 127 | 627 |
| Idaho | 1,007 | 19,600 | 7,590 | 0 | 7,590 | 12,100 | 0 | 12,100 | 19,700 | 0 | 19,700 | 0 | 7,160 | 6,090 |
| Illinois | 11,431 | 1,570 | 920 | 25 | 945 | 17,100 | 0 | 17,100 | 18,000 | 25 | 18,000 | 0 | 0 | 750 |
| Indiana | 5,544 | 1,700 | 621 | 0 | 621 | 8,810 | 0 | 8,810 | 9,430 | 0 | 9,430 | 0 | 0 | 451 |
| Iowa | 2,777 | 1,030 | 495 | 0 | 495 | 2,370 | 0 | 2,370 | 2,860 | 0 | 2,860 | 0 | 0 | 271 |
| Kansas | 2,478 | 2,460 | 4,360 | 0 | 4,360 | 1,720 | 0 | 1,720 | 6,080 | 0 | 6,080 | 60 | 146 | 4,410 |
| Kentucky | 3,685 | 1,170 | 247 | 0 | 247 | 4,070 | 0 | 4,070 | 4,320 | 0 | 4,320 | 0 | .5 | 309 |
| Louisiana | 4,220 | 2,200 | 1,340 | .6 | 1,340 | 7,950 | 67 | 8,010 | 9,290 | 67 | 9,350 | 0 | 90 | 1,590 |
| Maine | 1,228 | 433 | 85 | 0 | 85 | 446 | 609 | 1,060 | 532 | 609 | 1,140 | 0 | 0 | 51 |
| Maryland | 4,781 | 307 | 239 | 0 | 239 | 1,230 | 4,950 | 6,180 | 1,470 | 4,950 | 6,420 | 63 | 0 | 126 |
| Massachusetts | 6,016 | 338 | 338 | 0 | 338 | 1,690 | 3,490 | 5,180 | 2,030 | 3,490 | 5,520 | 0 | 0 | 195 |
| Michigan | 9,295 | 1,250 | 703 | 4.6 | 707 | 10,900 | 0 | 10,900 | 11,600 | 4.6 | 11,600 | 0 | 0 | 738 |
| Minnesota | 4,375 | 748 | 797 | 0 | 797 | 2,480 | 0 | 2,480 | 3,270 | 0 | 3,270 | 0 | 0 | 872 |
| Mississippi | 2,573 | 1,290 | 2,670 | 0 | 2,670 | 648 | 316 | 963 | 3,320 | 316 | 3,640 | 10 | 188 | 1,800 |
| Missouri | 5,117 | 1,150 | 727 | .1 | 728 | 5,150 | 1,060 | 6,200 | 5,870 | 1,060 | 6,930 | 0 | 0 | 529 |
| Montana | 799 | 11,600 | 205 | 13 | 218 | 9,100 | 0 | 9,100 | 9,300 | 13 | 9,320 | 0 | 4,620 | 2,090 |
| Nebraska | 1,578 | 5,660 | 4,790 | 4.7 | 4,800 | 4,150 | 0 | 4,150 | 8,940 | 4.7 | 8,940 | 0 | 2,160 | 4,230 |
| Nevada | 1,202 | 2,780 | 1,060 | 12 | 1,070 | 2,280 | 0 | 2,280 | 3,340 | 12 | 3,350 | 11 | 615 | 1,690 |
| New Hampshire | 1,109 | 378 | 64 | 0 | 64 | 356 | 894 | 1,250 | 420 | 894 | 1,310 | 0 | 0 | 26 |
| New Jersey | 7,730 | 287 | 566 | .2 | 566 | 1,650 | 10,600 | 12,200 | 2,220 | 10,600 | 12,800 | 0 | 0 | 211 |
| New Mexico | 1,515 | 2,300 | 1,760 | 0 | 1,760 | 1,720 | 0 | 1,720 | 3,480 | 0 | 3,480 | 0 | 590 | 2,060 |
| New York | 17,990 | 583 | 839 | 1.5 | 840 | 9,650 | 8,490 | 18,100 | 10,500 | 8,490 | 19,000 | 0 | 0 | 562 |
| North Carolina | 6,629 | 1,350 | 435 | 0 | 435 | 8,500 | 5.5 | 8,510 | 8,940 | 5.5 | 8,940 | 17 | 0 | 390 |
| North Dakota | 639 | 4,190 | 141 | 0 | 141 | 2,540 | 0 | 2,540 | 2,680 | 0 | 2,680 | 0 | 5.9 | 228 |
| Ohio | 10,847 | 1,080 | 904 | 0 | 904 | 10,800 | 0 | 10,800 | 11,700 | 0 | 11,700 | 0 | .1 | 901 |
| Oklahoma | 3,146 | 452 | 662 | 243 | 905 | 760 | 0 | 760 | 1,420 | 243 | 1,670 | 0 | 5.4 | 659 |
| Oregon | 2,842 | 2,970 | 767 | 0 | 767 | 7,660 | 0 | 7,660 | 8,430 | 0 | 8,430 | 12 | 1,270 | 3,160 |
| Pennsylvania | 11,882 | 827 | 1,020 | 0 | 1,020 | 8,810 | 0 | 8,810 | 9,830 | 0 | 9,830 | 0 | 0 | 581 |
| Rhode Island | 1,003 | 132 | 25 | 0 | 25 | 108 | 393 | 501 | 133 | 393 | 526 | 0 | 0 | 18 |
| South Carolina | 3,487 | 1,720 | 282 | 0 | 282 | 5,720 | 0 | 5,720 | 6,000 | 0 | 6,000 | 14 | 0 | 293 |
| South Dakota | 696 | 851 | 251 | 0 | 251 | 341 | 0 | 341 | 592 | 0 | 592 | 0 | 62 | 345 |
| Tennessee | 4,877 | 1,880 | 503 | 0 | 503 | 8,690 | 0 | 8,690 | 9,190 | 0 | 9,190 | .7 | 0 | 252 |
| Texas | 16,986 | 1,180 | 7,380 | 492 | 7,880 | 12,700 | 4,610 | 17,300 | 20,100 | 5,100 | 25,200 | 56 | 660 | 9,020 |
| Utah | 1,723 | 2,540 | 964 | 7.2 | 971 | 3,410 | 93 | 3,510 | 4,380 | 100 | 4,480 | 39 | 624 | 2,230 |
| Vermont | 563 | 1,120 | 45 | 0 | 45 | 587 | 0 | 587 | 632 | 0 | 632 | 0 | 0 | 29 |
| Virginia | 6,187 | 762 | 443 | 0 | 443 | 4,270 | 2,150 | 6,420 | 4,710 | 2,150 | 6,860 | 0 | 3.6 | 224 |
| Washington | 4,867 | 1,630 | 1,450 | 0 | 1,450 | 6,460 | 36 | 6,490 | 7,910 | 36 | 7,940 | 0 | 997 | 2,830 |
| West Virginia | 1,793 | 2,560 | 728 | 0 | 728 | 3,860 | 0 | 3,860 | 4,580 | 0 | 4,580 | 0 | 0 | 509 |
| Wisconsin | 4,892 | 1,330 | 681 | 0 | 681 | 5,830 | 0 | 5,830 | 6,510 | 0 | 6,510 | 0 | 0 | 461 |
| Wyoming | 454 | 16,700 | 384 | 19 | 403 | 7,200 | 0 | 7,200 | 7,580 | 19 | 7,600 | 0 | 2,150 | 2,730 |
| Puerto Rico | 3,522 | 163 | 157 | 0 | 157 | 419 | 2,470 | 2,880 | 576 | 2,470 | 3,040 | 0 | 17 | 199 |
| Virgin Islands | 102 | 91 | 1.9 | 1.2 | 3.1 | 7.4 | 153 | 160 | 9.3 | 154 | 164 | 0 | 0 | 1.5 |
| Total | 252,336 | 1,340 | 79,400 | 1,220 | 80,600 | 259,000 | 68,200 | 327,000 | 339,000 | 69,400 | 408,000 | 750 | 27,500 | 94,000 |

**Table 3.** Total water withdrawals by water-use category and water-resources region, 1990

[Figures may not add to totals because of independent rounding. All values in million gallons per day]

| REGION | PUBLIC SUPPLY | DOMESTIC | COMMER-CIAL | IRRIGATION | LIVESTOCK | INDUSTRIAL | | MINING | | THERMOELECTRIC | | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fresh | Fresh | Fresh | Fresh | Fresh | Fresh | Saline | Fresh | Saline | Fresh | Saline | Fresh | Saline |
| New England | 1,400 | 169 | 133 | 120 | 8.1 | 479 | 68 | 20 | 0.0 | 2,400 | 9,090 | 4,730 | 9,160 |
| Mid Atlantic | 5,980 | 396 | 133 | 197 | 107 | 1,730 | 1,470 | 387 | 30 | 12,200 | 25,000 | 21,100 | 26,500 |
| South Atlantic-Gulf | 4,850 | 659 | 134 | 4,450 | 350 | 2,810 | 94 | 437 | 9.1 | 19,700 | 10,700 | 33,400 | 10,800 |
| Great Lakes | 4,340 | 283 | 108 | 290 | 92 | 4,190 | 3.7 | 249 | 7.7 | 22,800 | 0 | 32,400 | 11 |
| Ohio | 2,530 | 360 | 89 | 68 | 132 | 2,370 | 0 | 1,000 | 22 | 23,900 | 0 | 30,400 | 22 |
| Tennessee | 511 | 56 | 56 | 27 | 201 | 1,190 | 0 | 92 | 0 | 7,070 | 0 | 9,200 | 0 |
| Upper Mississippi | 1,890 | 371 | 260 | 392 | 269 | 967 | 0 | 154 | 4.2 | 16,500 | 0 | 20,800 | 4.2 |
| Lower Mississippi | 1,040 | 90 | 92 | 7,380 | 1,070 | 2,620 | 67 | 40 | 0 | 5,640 | 1,060 | 18,000 | 1,120 |
| Souris-Red-Rainy | 72 | 22 | .3 | 98 | 21 | 49 | 0 | 8.2 | 0 | 26 | 0 | 295 | 0 |
| Missouri Basin | 1,620 | 139 | 40 | 24,800 | 415 | 171 | 0 | 279 | 37 | 10,000 | 0 | 37,500 | 37 |
| Arkansas-White-Red | 1,400 | 118 | 165 | 8,390 | 359 | 368 | 0 | 74 | 291 | 4,530 | 0 | 15,400 | 291 |
| Texas-Gulf | 2,520 | 79 | 57 | 5,100 | 156 | 741 | 1,460 | 130 | 399 | 4,710 | 3,150 | 13,500 | 5,010 |
| Rio Grande | 533 | 23 | 20 | 5,290 | 33 | 12 | 0 | 66 | 39 | 18 | 0 | 6,000 | 39 |
| Upper Colorado | 118 | 10 | 6.3 | 6,590 | 117 | 5.4 | 0 | 51 | 28 | 177 | 0 | 7,080 | 28 |
| Lower Colorado | 1,070 | 39 | 29 | 6,060 | 98 | 174 | 0 | 170 | .7 | 109 | .4 | 7,750 | 1.2 |
| Great Basin | 610 | 15 | 16 | 6,300 | 37 | 106 | 2.3 | 83 | 110 | 31 | 0 | 7,200 | 112 |
| Pacific Northwest | 1,580 | 220 | 718 | 31,800 | 620 | 1,030 | 36 | 15 | 0 | 355 | 0 | 36,300 | 36 |
| California | 5,750 | 313 | 271 | 28,300 | 405 | 130 | 25 | 22 | 310 | 246 | 11,400 | 35,400 | 11,700 |
| Alaska | 92 | 6.9 | 18 | .6 | .6 | 111 | 0 | 25 | 357 | 31 | 0 | 284 | 357 |
| Hawaii | 238 | 9.9 | 40 | 755 | 7.2 | 43 | .6 | 1.4 | 0 | 95 | 1,550 | 1,190 | 1,550 |
| Caribbean | 411 | 8.2 | .8 | 140 | 8.9 | 11 | 51 | 2.6 | 0 | 2.6 | 2,570 | 585 | 2,620 |
| Total | 38,500 | 3,390 | 2,390 | 137,000 | 4,500 | 19,300 | 3,270 | 3,310 | 1,650 | 131,000 | 64,500 | 339,000 | 69,400 |

**Table 4.** Total water withdrawals by water-use category and State, 1990

[Figures may not add to totals because of independent rounding. All values in million gallons per day]

| STATE | PUBLIC SUPPLY | DOMESTIC | COMMER-CIAL | IRRIGATION | LIVESTOCK | INDUSTRIAL | | MINING | | THERMOELECTRIC | | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fresh | Fresh | Fresh | Fresh | Fresh | Fresh | Saline | Fresh | Saline | Fresh | Saline | Fresh | Saline |
| Alabama | 707 | 28 | 3.5 | 94 | 141 | 784 | 0.0 | 11 | 9.1 | 6,310 | 0.0 | 8,080 | 9.1 |
| Alaska | 92 | 6.9 | 18 | .6 | .6 | 111 | 0 | 25 | 357 | 31 | 0 | 284 | 357 |
| Arizona | 707 | 32 | 18 | 5,300 | 89 | 163 | 0 | 156 | .7 | 103 | .4 | 6,570 | 1.2 |
| Arkansas | 309 | 51 | 222 | 5,250 | 189 | 177 | 0 | 2.5 | 0 | 1,640 | 0 | 7,840 | 0 |
| California | 5,830 | 318 | 234 | 27,900 | 411 | 129 | 25 | 20 | 310 | 246 | 11,400 | 35,100 | 11,700 |
| Colorado | 650 | 19 | 8.6 | 11,600 | 162 | 118 | 0 | 54 | 30 | 114 | 0 | 12,700 | 30 |
| Connecticut | 374 | 46 | 18 | 15 | 1.5 | 80 | 68 | 2.2 | 0 | 530 | 3,710 | 1,070 | 3,780 |
| Delaware | 85 | 11 | 1.8 | 32 | 2.4 | 65 | 60 | 0 | 0 | 831 | 333 | 1,030 | 339 |
| D.C. | 0 | 0 | 0 | 0 | 0 | .5 | 0 | .5 | 0 | 80 | 0 | 90 | 0 |
| Florida | 1,930 | 299 | 52 | 3,730 | 78 | 403 | 56 | 315 | 0 | 732 | 10,300 | 7,530 | 10,400 |
| Georgia | 963 | 100 | 42 | 441 | 46 | 657 | 33 | 12 | 0 | 3,030 | 33 | 5,290 | 65 |
| Hawaii | 238 | 9.9 | 40 | 755 | 7.2 | 43 | .6 | 1.4 | 0 | 95 | 1,550 | 1,190 | 1,550 |
| Idaho | 201 | 48 | 16 | 18,700 | 560 | 196 | 0 | 8.4 | 0 | 6.1 | 0 | 19,700 | 0 |
| Illinois | 1,860 | 115 | 173 | 78 | 63 | 464 | 0 | 69 | 25 | 15,200 | 0 | 18,000 | 25 |
| Indiana | 604 | 118 | 63 | 51 | 46 | 2,480 | 0 | 97 | 0 | 5,960 | 0 | 9,430 | 0 |
| Iowa | 322 | 45 | 27 | 23 | 121 | 219 | 0 | 34 | 0 | 2,070 | 0 | 2,860 | 0 |
| Kansas | 373 | 25 | 6.2 | 4,190 | 114 | 53 | 0 | 26 | 0 | 1,300 | 0 | 6,080 | 0 |
| Kentucky | 427 | 56 | 13 | 12 | 33 | 313 | 0 | 18 | 0 | 3,440 | 0 | 4,320 | 0 |
| Louisiana | 619 | 50 | 13 | 708 | 551 | 2,360 | 67 | 37 | 0 | 4,950 | 0 | 9,290 | 67 |
| Maine | 106 | 49 | 34 | 1.8 | 1.7 | 254 | 0 | 3.7 | 0 | 82 | 609 | 532 | 609 |
| Maryland | 798 | 70 | 26 | 29 | 27 | 70 | 379 | 28 | 21 | 421 | 4,550 | 1,470 | 4,950 |
| Massachusetts | 714 | 37 | 74 | 100 | 1.7 | 87 | 0 | 50 | 0 | 1,010 | 3,490 | 2,030 | 3,490 |
| Michigan | 1,400 | 123 | 35 | 240 | 29 | 1,680 | 3.7 | 55 | .9 | 8,060 | 0 | 11,600 | 4.6 |
| Minnesota | 515 | 168 | 71 | 195 | 67 | 154 | 0 | 220 | 0 | 1,880 | 0 | 3,270 | 0 |
| Mississippi | 320 | 33 | 16 | 1,880 | 411 | 269 | 0 | 3.4 | 0 | 386 | 316 | 3,320 | 316 |
| Missouri | 677 | 62 | 22 | 371 | 55 | 85 | 0 | 25 | .1 | 4,580 | 1,060 | 5,870 | 1,060 |
| Montana | 135 | 16 | 0 | 9,000 | 52 | 57 | 0 | 6.2 | 13 | 33 | 0 | 9,300 | 13 |
| Nebraska | 301 | 47 | .2 | 6,100 | 139 | 41 | 0 | 131 | 4.7 | 2,180 | 0 | 8,940 | 4.7 |
| Nevada | 385 | 9.8 | 23 | 2,820 | 5.6 | 10 | 0 | 49 | 12 | 34 | 0 | 3,340 | 12 |
| New Hampshire | 95 | 27 | .6 | .9 | 10 | 37 | 0 | 2.8 | 0 | 255 | 894 | 420 | 894 |
| New Jersey | 1,040 | 68 | 17 | 58 | 2.1 | 326 | 1,020 | 110 | 0 | 599 | 9,550 | 2,220 | 10,600 |
| New Mexico | 273 | 24 | 17 | 3,010 | 22 | 6.3 | 0 | 80 | 0 | 50 | 0 | 3,480 | 0 |
| New York | 2,910 | 120 | 61 | 54 | 26 | 274 | 0 | 45 | 16 | 6,990 | 8,470 | 10,500 | 8,490 |
| North Carolina | 805 | 103 | 17 | 114 | 201 | 390 | 5.5 | 96 | 0 | 7,210 | 0 | 8,940 | 5.5 |
| North Dakota | 76 | 12 | .1 | 164 | 24 | 8.8 | 0 | 3.7 | 0 | 2,390 | 0 | 2,680 | 0 |
| Ohio | 1,300 | 134 | 36 | 15 | 34 | 354 | 0 | 243 | 0 | 9,550 | 0 | 11,700 | 0 |
| Oklahoma | 515 | 41 | 6.3 | 601 | 131 | 35 | 0 | 2.8 | 243 | 89 | 0 | 1,420 | 243 |
| Oregon | 470 | 64 | 711 | 6,860 | 21 | 284 | 0 | 1.5 | 0 | 15 | 0 | 8,430 | 0 |
| Pennsylvania | 1,730 | 141 | 24 | 14 | 53 | 1,870 | 0 | 252 | 0 | 5,750 | 0 | 9,830 | 0 |
| Rhode Island | 102 | 4.9 | 5.6 | 2.1 | .3 | 12 | 0 | 6.8 | 0 | 0 | 393 | 133 | 393 |
| South Carolina | 352 | 103 | 2.1 | 55 | 25 | 632 | 0 | 12 | 0 | 4,820 | 0 | 6,000 | 0 |
| South Dakota | 76 | 8.8 | 17 | 392 | 43 | 15 | 0 | 38 | 0 | 3.2 | 0 | 592 | 0 |
| Tennessee | 695 | 59 | 55 | 38 | 49 | 882 | 0 | 90 | 0 | 7,320 | 0 | 9,190 | 0 |
| Texas | 3,090 | 93 | 62 | 8,490 | 228 | 884 | 1,460 | 139 | 491 | 7,130 | 3,150 | 20,100 | 5,100 |
| Utah | 508 | 6.1 | 4.2 | 3,590 | 34 | 106 | 2.3 | 41 | 98 | 87 | 0 | 4,380 | 100 |
| Vermont | 39 | 17 | 3.8 | .5 | 6.1 | 44 | 0 | 3.7 | 0 | 519 | 0 | 632 | 0 |
| Virginia | 709 | 113 | 35 | 36 | 29 | 495 | 66 | 91 | 0 | 3,210 | 2,080 | 4,710 | 2,150 |
| Washington | 875 | 104 | 27 | 6,030 | 30 | 501 | 36 | 30 | 0 | 334 | 0 | 7,910 | 36 |
| West Virginia | 160 | 49 | 3.1 | 0 | 4.8 | 132 | 0 | 527 | 0 | 3,710 | 0 | 4,580 | 0 |
| Wisconsin | 595 | 90 | 11 | 151 | 99 | 468 | 0 | .2 | 0 | 5,100 | 0 | 6,510 | 0 |
| Wyoming | 88 | 8.5 | 1.6 | 7,160 | 27 | 16 | 0 | 101 | 19 | 184 | 0 | 7,580 | 19 |
| Puerto Rico | 404 | 6.7 | .1 | 140 | 8.3 | 11 | 0 | 2.6 | 0 | 2.6 | 2,470 | 576 | 2,470 |
| Virgin Islands | 6.4 | 1.6 | .7 | 0 | .5 | .1 | 51 | 0 | 0 | 0 | 103 | 9.3 | 154 |
| Total | 38,500 | 3,390 | 2,390 | 137,000 | 4,500 | 19,300 | 3,270 | 3,310 | 1,650 | 131,000 | 64,500 | 339,000 | 69,400 |

**Table 5.** Surface-water withdrawals by water-use category and water-resources region, 1990

[Figures may not add to totals because of independent rounding. All values in million gallons per day]

| STATE | PUBLIC SUPPLY | DOMESTIC | COMMERCIAL | IRRIGATION | LIVESTOCK | INDUSTRIAL | | MINING | | THERMOELECTRIC | | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fresh | Fresh | Fresh | Fresh | Fresh | Fresh | Saline | Fresh | Saline | Fresh | Saline | Fresh | Saline |
| New England | 1,070 | 0.0 | 51 | 111 | 2.8 | 382 | 68 | 19 | 0.0 | 2,400 | 9,090 | 4,040 | 9,160 |
| Mid Atlantic | 4,580 | .1 | 39 | 95 | 36 | 1,370 | 1,470 | 176 | 29 | 12,200 | 25,000 | 18,500 | 26,500 |
| South Atlantic-Gulf | 2,340 | 0 | 14 | 2,160 | 152 | 1,920 | 94 | 53 | 0 | 19,700 | 10,700 | 26,300 | 10,800 |
| Great Lakes | 3,880 | 10 | 81 | 158 | 41 | 3,950 | 0 | 227 | 6.5 | 22,800 | 0 | 31,200 | 6.5 |
| Ohio | 1,750 | 8.1 | 31 | 40 | 79 | 1,840 | 0 | 218 | .6 | 23,800 | 0 | 27,800 | .6 |
| Tennessee | 402 | 0 | .2 | 23 | 169 | 1,170 | 0 | 67 | 0 | 7,070 | 0 | 8,900 | 0 |
| Upper Mississippi | 724 | 0 | 126 | 38 | 52 | 618 | 0 | 143 | 0 | 16,500 | 0 | 18,200 | 0 |
| Lower Mississippi | 334 | 0 | 72 | 1,150 | 358 | 2,120 | 67 | 32 | 0 | 5,570 | 1,060 | 9,630 | 1,120 |
| Souris-Red-Rainy | 37 | 0 | .2 | 42 | 4.9 | 47 | 0 | 80 | 0 | 26 | 0 | 166 | 0 |
| Missouri Basin | 1,010 | 10 | 6.4 | 17,600 | 172 | 57 | 0 | 182 | 0 | 9,980 | 0 | 29,000 | 0 |
| Arkansas-White-Red | 1,040 | 0 | 138 | 1,790 | 200 | 301 | 0 | 25 | 0 | 4,500 | 0 | 7,990 | 0 |
| Texas-Gulf | 1,470 | 0 | 11 | 1,130 | 102 | 600 | 1,460 | 47 | 0 | 4,660 | 3,150 | 8,020 | 4,610 |
| Rio Grande | 163 | 0 | 1.2 | 3,670 | 13 | 10 | 0 | 1.5 | 0 | 1.8 | 0 | 3,850 | 0 |
| Upper Colorado | 86 | .3 | .7 | 6,560 | 112 | 2.5 | 0 | 12 | 0 | 177 | 0 | 6,950 | 0 |
| Lower Colorado | 552 | 2.1 | 6.3 | 3,820 | 68 | 124 | 0 | 30 | .2 | 62 | .4 | 4,670 | .6 |
| Great Basin | 256 | 2.6 | 9.3 | 4,890 | 9.9 | 29 | 0 | 5.7 | 93 | 24 | 0 | 5,230 | 93 |
| Pacific Northwest | 850 | 7.7 | 669 | 23,900 | 29 | 691 | 36 | 10 | 0 | 345 | 0 | 26,500 | 36 |
| California | 2,530 | 103 | 213 | 17,700 | 204 | 4.8 | 25 | 70 | .4 | 241 | 11,400 | 21,000 | 11,400 |
| Alaska | 58 | .7 | 90 | .5 | .5 | 106 | 0 | 20 | 308 | 26 | 0 | 221 | 308 |
| Hawaii | 17 | 1.4 | .6 | 555 | 3.8 | 23 | 0 | 0 | 0 | 0 | 1,550 | 600 | 1,550 |
| Caribbean | 330 | 4.6 | .3 | 87 | 3.7 | 0 | 50 | .7 | 0 | 0 | 2,570 | 426 | 2,620 |
| Total | 23,500 | 132 | 1,480 | 85,500 | 1,810 | 15,400 | 3,260 | 1,280 | 438 | 130,000 | 64,500 | 259,000 | 68,200 |

## Table 6. Surface-water withdrawals by water-use category and State, 1990

[Figures may not add to totals because of independent rounding. All values in million gallons per day]

| STATE | PUBLIC SUPPLY | DOMESTIC | COMMERCIAL | IRRIGATION | LIVESTOCK | INDUSTRIAL | | MINING | | THERMOELECTRIC | | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fresh | Fresh | Fresh | Fresh | Fresh | Fresh | Saline | Fresh | Saline | Fresh | Saline | Fresh | Saline |
| Alabama | 483 | 0.0 | 0.3 | 62 | 69 | 753 | 0.0 | 70 | 0.0 | 6,310 | 0.0 | 7,680 | 0.0 |
| Alaska | 58 | .7 | 90 | .5 | .5 | 106 | 0 | 20 | 308 | 26 | 0 | 221 | 308 |
| Arizona | 305 | .3 | 0 | 3,250 | 64 | 124 | 0 | 29 | .2 | 61 | .4 | 3,830 | .6 |
| Arkansas | 190 | 0 | 207 | 949 | 64 | 78 | 0 | .7 | 0 | 1,640 | 0 | 3,130 | 0 |
| California | 2,560 | 106 | 177 | 17,200 | 206 | 3.4 | 25 | 70 | .4 | 241 | 11,400 | 20,500 | 11,400 |
| Colorado | 567 | 0 | .9 | 9,000 | 140 | 85 | 0 | 26 | 0 | 94 | 0 | 9,910 | 0 |
| Connecticut | 301 | 0 | .6 | 6.5 | .4 | 61 | 68 | 1.8 | 0 | 530 | 3,710 | 902 | 3,780 |
| Delaware | 52 | 0 | 0 | 9.5 | .3 | 47 | 60 | 0 | 0 | 830 | 333 | 939 | 339 |
| D.C. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 80 | 0 | 80 | 0 |
| Florida | 226 | 0 | 1.5 | 1,780 | 9.6 | 121 | 56 | 17 | 0 | 709 | 10,300 | 2,870 | 10,400 |
| Georgia | 730 | 0 | 12 | 178 | 36 | 311 | 33 | 2.9 | 0 | 3,020 | 33 | 4,290 | 65 |
| Hawaii | 17 | 1.4 | .6 | 555 | 3.8 | 23 | 0 | 0 | 0 | 0 | 1,550 | 600 | 1,550 |
| Idaho | 28 | 0 | 0 | 12,100 | 0 | 26 | 0 | 7.8 | 0 | 0 | 0 | 12,100 | 0 |
| Illinois | 1,420 | 0 | 119 | 3.7 | 2.2 | 309 | 0 | 61 | 0 | 15,200 | 0 | 17,100 | 0 |
| Indiana | 330 | 0 | 31 | 31 | 20 | 2,350 | 0 | 88 | 0 | 5,950 | 0 | 8,810 | 0 |
| Iowa | 88 | 0 | 80 | 1.4 | 30 | 148 | 0 | 33 | 0 | 2,060 | 0 | 2,370 | 0 |
| Kansas | 197 | 0 | 0 | 199 | 31 | 3.8 | 0 | .9 | 0 | 1,290 | 0 | 1,720 | 0 |
| Kentucky | 372 | 5.5 | 9.2 | 11 | 31 | 220 | 0 | 13 | 0 | 3,410 | 0 | 4,070 | 0 |
| Louisiana | 344 | 0 | .9 | 256 | 329 | 2,070 | 67 | 36 | 0 | 4,910 | 0 | 7,950 | 67 |
| Maine | 86 | 0 | 30 | 1.6 | 1.1 | 244 | 0 | 2.9 | 0 | 81 | 609 | 446 | 609 |
| Maryland | 722 | 0 | 6.4 | 10 | 14 | 50 | 379 | 7.5 | 21 | 419 | 4,550 | 1,230 | 4,950 |
| Massachusetts | 535 | 0 | 18 | 100 | .4 | 22 | 0 | 50 | 0 | 1,010 | 3,490 | 1,690 | 3,490 |
| Michigan | 1,140 | .1 | 27 | 135 | 10 | 1,510 | 0 | 46 | 0 | 8,050 | 0 | 10,900 | 0 |
| Minnesota | 225 | 0 | 16 | 38 | 10 | 89 | 0 | 217 | 0 | 1,880 | 0 | 2,480 | 0 |
| Mississippi | 38 | 0 | 0 | 130 | 12 | 126 | 0 | .5 | 0 | 342 | 316 | 648 | 316 |
| Missouri | 493 | 0 | 0 | 36 | 41 | 32 | 0 | .1 | 0 | 4,540 | 1,060 | 5,150 | 1,060 |
| Montana | 83 | .8 | 0 | 8,910 | 36 | 27 | 0 | 3.6 | 0 | 33 | 0 | 9,100 | 0 |
| Nebraska | 66 | 0 | 0 | 1,740 | 31 | 2.4 | 0 | 130 | 0 | 2,180 | 0 | 4,150 | 0 |
| Nevada | 281 | .2 | 16 | 1,950 | 4.6 | .8 | 0 | 3.5 | 0 | 22 | 0 | 2,280 | 0 |
| New Hampshire | 61 | 0 | .2 | .8 | .3 | 37 | 0 | 2.7 | 0 | 254 | 894 | 356 | 894 |
| New Jersey | 643 | 0 | 1.4 | 36 | 0 | 273 | 1,020 | 103 | 0 | 597 | 9,550 | 1,650 | 10,600 |
| New Mexico | 32 | 0 | 1.2 | 1,640 | 3.6 | 1.7 | 0 | 2.4 | 0 | 40 | 0 | 1,720 | 0 |
| New York | 2,360 | 0 | 32 | 26 | 10 | 189 | 0 | 34 | 15 | 6,990 | 8,470 | 9,650 | 8,490 |
| North Carolina | 668 | 0 | 0 | 102 | 165 | 328 | 5.5 | 28 | 0 | 7,210 | 0 | 8,500 | 5.5 |
| North Dakota | 45 | 0 | 0 | 86 | 11 | 6.6 | 0 | .7 | 0 | 2,390 | 0 | 2,540 | 0 |
| Ohio | 904 | 2.7 | 11 | 11 | 26 | 230 | 0 | 40 | 0 | 9,540 | 0 | 10,800 | 0 |
| Oklahoma | 435 | 0 | 1.5 | 108 | 96 | 32 | 0 | .5 | 0 | 88 | 0 | 760 | 0 |
| Oregon | 365 | 7.6 | 704 | 6,300 | 18 | 254 | 0 | .6 | 0 | 15 | 0 | 7,660 | 0 |
| Pennsylvania | 1,300 | 0 | 10 | 11 | 6.9 | 1,690 | 0 | 41 | 0 | 5,750 | 0 | 8,810 | 0 |
| Rhode Island | 88 | 0 | 1.3 | 1.8 | .2 | 9.1 | 0 | 6.8 | 0 | 0 | 393 | 108 | 393 |
| South Carolina | 273 | 0 | 0 | 25 | 12 | 585 | 0 | 3.6 | 0 | 4,820 | 0 | 5,720 | 0 |
| South Dakota | 24 | 0 | 4.6 | 251 | 26 | 10 | 0 | 23 | 0 | 2.8 | 0 | 341 | 0 |
| Tennessee | 426 | 0 | 0 | 23 | 21 | 813 | 0 | 82 | 0 | 7,320 | 0 | 8,690 | 0 |
| Texas | 1,830 | 0 | 11 | 2,900 | 135 | 741 | 1,460 | 46 | 0 | 7,070 | 3,150 | 12,700 | 4,610 |
| Utah | 203 | 1.4 | 0 | 3,080 | 70 | 29 | 0 | 3.6 | 93 | 87 | 0 | 3,410 | 93 |
| Vermont | 19 | 0 | 10 | .5 | 1.5 | 43 | 0 | 3.4 | 0 | 518 | 0 | 587 | 0 |
| Virginia | 640 | 0 | 8.3 | 28 | 21 | 300 | 66 | 68 | 0 | 3,210 | 2,080 | 4,270 | 2,150 |
| Washington | 441 | 0 | .4 | 5,280 | 8.4 | 397 | 36 | .6 | 0 | 330 | 0 | 6,460 | 36 |
| West Virginia | 118 | 10 | .6 | 0 | 3.6 | 26 | 0 | 0 | 0 | 3,710 | 0 | 3,860 | 0 |
| Wisconsin | 301 | 0 | 0 | 1.8 | 25 | 409 | 0 | 0 | 0 | 5,090 | 0 | 5,830 | 0 |
| Wyoming | 47 | .4 | .7 | 6,920 | 13 | 9.9 | 0 | 26 | 0 | 183 | 0 | 7,200 | 0 |
| Puerto Rico | 325 | 3.2 | 0 | 87 | 3.5 | 0 | 0 | .7 | 0 | 0 | 2,470 | 419 | 2,470 |
| Virgin Islands | 5.4 | 1.4 | .3 | 0 | .2 | 0 | 50 | 0 | 0 | 0 | 103 | 7.4 | 153 |
| Total | 23,500 | 132 | 1,480 | 85,500 | 1,810 | 15,400 | 3,260 | 1,280 | 438 | 130,000 | 64,500 | 259,000 | 68,200 |

**Table 7.** Ground-water withdrawals by water-use category and water-resources region, 1990
[Figures may not add to totals because of independent rounding. All values in million gallons per day]

| REGION | PUBLIC SUPPLY | DOMESTIC | COMMER-CIAL | IRRIGATION | LIVESTOCK | INDUSTRIAL | | MINING | | THERMOELECTRIC | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fresh | Fresh | Fresh | Fresh | Fresh | Fresh | Saline | Fresh | Saline | Fresh | Fresh | Saline |
| New England | 328 | 169 | 82 | 8.8 | 5.4 | 96 | 0.0 | 1.3 | 0.0 | 2.9 | 694 | 0.0 |
| Mid Atlantic | 1,400 | 396 | 94 | 102 | 71 | 360 | .2 | 210 | 10 | 4.6 | 2,640 | 1.2 |
| South Atlantic-Gulf | 2,510 | 659 | 120 | 2,300 | 198 | 896 | 0 | 384 | 9.1 | 41 | 7,110 | 9.1 |
| Great Lakes | 460 | 282 | 27 | 132 | 51 | 235 | 3.7 | 22 | 1.2 | 3.2 | 1,210 | 4.9 |
| Ohio | 774 | 352 | 58 | 28 | 54 | 532 | 0 | 784 | 22 | 65 | 2,650 | 22 |
| Tennessee | 109 | 56 | 56 | 3.8 | 32 | 23 | 0 | 25 | 0 | 0 | 305 | 0 |
| Upper Mississippi | 1,160 | 371 | 134 | 354 | 217 | 349 | 0 | 11 | 4.2 | 21 | 2,620 | 4.2 |
| Lower Mississippi | 701 | 90 | 20 | 6,230 | 710 | 501 | .6 | 7.9 | 0 | 75 | 8,340 | .6 |
| Souris-Red-Rainy | 34 | 22 | .1 | 56 | 16 | 1.3 | 0 | .2 | 0 | 0 | 130 | 0 |
| Missouri Basin | 612 | 138 | 33 | 7,200 | 242 | 114 | 0 | 96 | 37 | 50 | 8,490 | 37 |
| Arkansas-White-Red. | 364 | 118 | 27 | 6,600 | 158 | 67 | 0 | 49 | 291 | 31 | 7,420 | 291 |
| Texas-Gulf | 1,050 | 79 | 47 | 3,970 | 54 | 141 | 1.1 | 84 | 399 | 46 | 5,480 | 400 |
| Rio Grande | 370 | 23 | 19 | 1,620 | 20 | 11 | 0 | 65 | 39 | 16 | 2,140 | 39 |
| Upper Colorado | 32 | 9.9 | 5.6 | 32 | 5.3 | 2.9 | 0 | 39 | 28 | 0 | 127 | 28 |
| Lower Colorado | 513 | 37 | 23 | 2,240 | 30 | 49 | 0 | 139 | .6 | 47 | 3,080 | .6 |
| Great Basin | 354 | 13 | 70 | 1,410 | 27 | 77 | 2.3 | 77 | 17 | 7.2 | 1,970 | 19 |
| Pacific Northwest | 727 | 212 | 49 | 7,850 | 591 | 336 | 0 | 50 | 0 | 10 | 9,780 | 0 |
| California | 3,210 | 210 | 58 | 10,600 | 201 | 126 | 0 | 15 | 310 | 4.6 | 14,400 | 310 |
| Alaska | 34 | 6.2 | 8.7 | .1 | .1 | 5.2 | 0 | 4.3 | 48 | 4.7 | 64 | 48 |
| Hawaii | 221 | 8.5 | 39 | 200 | 3.4 | 20 | .6 | 1.4 | 0 | 95 | 589 | .6 |
| Caribbean | 81 | 3.7 | .4 | 54 | 5.2 | 11 | 1.2 | 1.9 | 0 | 2.6 | 159 | 1.2 |
| Total | 15,100 | 3,260 | 908 | 51,000 | 2,690 | 3,950 | 9.7 | 2,020 | 1,210 | 525 | 79,400 | 1,220 |

**Table 8.** Ground-water withdrawals by water-use category and State, 1990

[Figures may not add to totals because of independent rounding. All values in million gallons per day]

| STATE | PUBLIC SUPPLY | DOMESTIC | COMMER-CIAL | IRRIGATION | LIVESTOCK | INDUSTRIAL | | MINING | | THERMO-ELECTRIC | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fresh | Fresh | Fresh | Fresh | Fresh | Fresh | Saline | Fresh | Saline | Fresh | Fresh | Saline |
| Alabama | 224 | 28 | 3.1 | 33 | 72 | 31 | 0.0 | 40 | 9.1 | 0.0 | 394 | 9.1 |
| Alaska | 34 | 6.2 | 8.7 | .1 | .1 | 5.2 | 0 | 4.3 | 48 | 4.7 | 64 | 48 |
| Arizona | 401 | 32 | 18 | 2,060 | 26 | 39 | 0 | 127 | .5 | 42 | 2,740 | .5 |
| Arkansas | 119 | 51 | 14 | 4,300 | 125 | 99 | 0 | 1.8 | 0 | 2.4 | 4,710 | 0 |
| California | 3,260 | 212 | 57 | 10,700 | 205 | 125 | 0 | 13 | 310 | 4.6 | 14,600 | 310 |
| Colorado | 83 | 19 | 7.7 | 2,560 | 22 | 33 | 0 | 28 | 30 | 21 | 2,770 | 30 |
| Connecticut | 73 | 46 | 18 | 8.2 | 1.1 | 19 | 0 | .4 | 0 | .2 | 165 | 0 |
| Delaware | 33 | 11 | 1.8 | 23 | 2.1 | 18 | 0 | 0 | 0 | .5 | 89 | 0 |
| D.C. | 0 | 0 | 0 | 0 | 0 | .5 | 0 | .5 | 0 | 0 | 10 | 0 |
| Florida | 1,700 | 299 | 50 | 1,940 | 69 | 282 | 0 | 299 | 0 | 23 | 4,660 | 0 |
| Georgia | 234 | 100 | 30 | 263 | 9.9 | 346 | 0 | 8.7 | 0 | 5.2 | 996 | 0 |
| Hawaii | 221 | 8.5 | 39 | 200 | 3.4 | 20 | .6 | 1.4 | 0 | 95 | 589 | .6 |
| Idaho | 173 | 48 | 16 | 6,620 | 560 | 170 | 0 | .6 | 0 | 6.1 | 7,590 | 0 |
| Illinois | 444 | 115 | 54 | 75 | 61 | 155 | 0 | 7.6 | 25 | 90 | 920 | 25 |
| Indiana | 274 | 118 | 33 | 20 | 26 | 129 | 0 | 9.5 | 0 | 12 | 621 | 0 |
| Iowa | 234 | 45 | 19 | 21 | 91 | 71 | 0 | .7 | 0 | 12 | 495 | 0 |
| Kansas | 176 | 25 | 6.2 | 3,990 | 83 | 50 | 0 | 25 | 0 | 13 | 4,360 | 0 |
| Kentucky | 55 | 50 | 4.2 | .5 | 1.6 | 93 | 0 | 5.2 | 0 | 38 | 247 | 0 |
| Louisiana | 275 | 50 | 12 | 451 | 222 | 289 | .6 | .4 | 0 | 40 | 1,340 | .6 |
| Maine | 21 | 49 | 3.6 | .2 | .6 | 9.8 | 0 | .7 | 0 | 1.4 | 85 | 0 |
| Maryland | 76 | 70 | 19 | 19 | 12 | 20 | 0 | 21 | 0 | 1.8 | 239 | 0 |
| Massachusetts | 179 | 37 | 55 | 0 | 1.4 | 65 | 0 | 0 | 0 | .5 | 338 | 0 |
| Michigan | 261 | 123 | 8.1 | 105 | 19 | 175 | 3.7 | 8.8 | .9 | 2.8 | 703 | 4.6 |
| Minnesota | 290 | 168 | 56 | 157 | 57 | 65 | 0 | 2.4 | 0 | 2.4 | 797 | 0 |
| Mississippi | 282 | 33 | 16 | 1,750 | 399 | 144 | 0 | 2.9 | 0 | 43 | 2,670 | 0 |
| Missouri | 185 | 62 | 22 | 335 | 14 | 53 | 0 | 25 | .1 | 32 | 727 | .1 |
| Montana | 51 | 15 | 0 | 90 | 16 | 30 | 0 | 2.6 | 13 | 0 | 205 | 13 |
| Nebraska | 235 | 47 | .2 | 4,360 | 108 | 39 | 0 | 1.2 | 4.7 | 60 | 4,790 | 4.7 |
| Nevada | 104 | 9.6 | 7.1 | 871 | 10 | 9.4 | 0 | 45 | 12 | 12 | 1,060 | 12 |
| New Hampshire | 34 | 27 | .4 | .1 | .8 | .3 | 0 | .1 | 0 | .8 | 64 | 0 |
| New Jersey | 396 | 68 | 15 | 22 | 2.1 | 53 | .2 | 7.8 | 0 | 1.6 | 566 | .2 |
| New Mexico | 241 | 24 | 16 | 1,370 | 18 | 4.6 | 0 | 77 | 0 | 9.9 | 1,760 | 0 |
| New York | 550 | 120 | 29 | 28 | 15 | 85 | 0 | 11 | 1.5 | 0 | 839 | 1.5 |
| North Carolina | 137 | 103 | 17 | 12 | 36 | 63 | 0 | 68 | 0 | 0 | 435 | 0 |
| North Dakota | 32 | 12 | .1 | 78 | 13 | 2.1 | 0 | 30 | 0 | .1 | 141 | 0 |
| Ohio | 396 | 131 | 25 | 4.7 | 7.8 | 123 | 0 | 203 | 0 | 13 | 904 | 0 |
| Oklahoma | 80 | 41 | 4.8 | 493 | 35 | 3.3 | 0 | 2.2 | 243 | 1.8 | 662 | 243 |
| Oregon | 105 | 57 | 7.3 | 563 | 3.2 | 31 | 0 | 10 | 0 | 0 | 767 | 0 |
| Pennsylvania | 427 | 141 | 14 | 3.5 | 46 | 180 | 0 | 211 | 0 | 0 | 1,020 | 0 |
| Rhode Island | 13 | 4.9 | 4.2 | .3 | .1 | 2.5 | 0 | 0 | 0 | 0 | 25 | 0 |
| South Carolina | 79 | 103 | 2.1 | 30 | 12 | 47 | 0 | 80 | 0 | 1.4 | 282 | 0 |
| South Dakota | 52 | 8.8 | 12 | 141 | 17 | 50 | 0 | 15 | 0 | .4 | 251 | 0 |
| Tennessee | 269 | 59 | 55 | 15 | 29 | 69 | 0 | 8.2 | 0 | 0 | 503 | 0 |
| Texas | 1,270 | 93 | 51 | 5,590 | 93 | 143 | 1.1 | 93 | 491 | 54 | 7,380 | 492 |
| Utah | 305 | 4.6 | 4.2 | 508 | 27 | 77 | 2.3 | 37 | 50 | 0 | 964 | 7.2 |
| Vermont | 19 | 17 | 2.8 | 0 | 4.6 | 10 | 0 | .3 | 0 | .4 | 45 | 0 |
| Virginia | 69 | 113 | 27 | 7.9 | 8.5 | 195 | 0 | 23 | 0 | .4 | 443 | 0 |
| Washington | 434 | 104 | 27 | 754 | 22 | 104 | 0 | 2.4 | 0 | 40 | 1,450 | 0 |
| West Virginia | 43 | 48 | 2.5 | 0 | 1.3 | 106 | 0 | 527 | 0 | .4 | 728 | 0 |
| Wisconsin | 294 | 90 | 11 | 150 | 74 | 58 | 0 | .2 | 0 | 2.4 | 681 | 0 |
| Wyoming | 41 | 8.1 | .9 | 237 | 14 | 60 | 0 | 75 | 19 | 10 | 384 | 19 |
| Puerto Rico | 80 | 3.5 | .1 | 54 | 4.8 | 11 | 0 | 1.9 | 0 | 2.6 | 157 | 0 |
| Virgin Islands | 10 | .2 | .4 | 0 | .3 | .1 | 1.2 | 0 | 0 | 0 | 1.9 | 1.2 |
| Total | 15,100 | 3,260 | 908 | 51,000 | 2,690 | 3,950 | 9.7 | 2,020 | 1,210 | 525 | 79,400 | 1,220 |

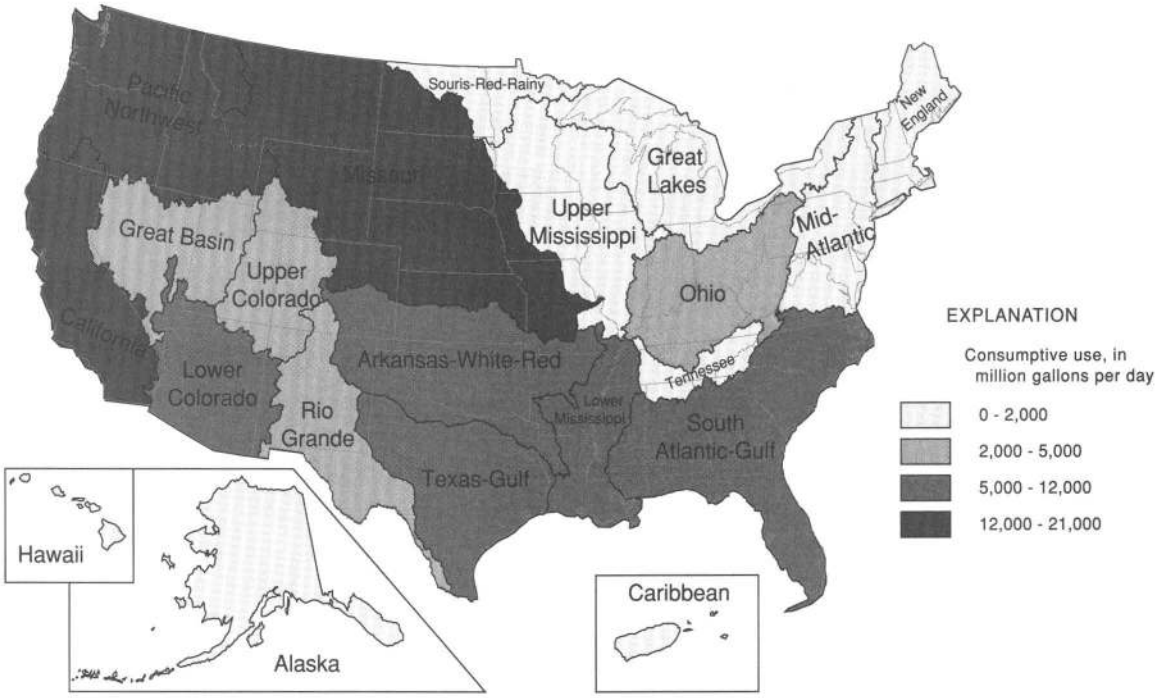



**Figure 3.** Freshwater consumptive use by water-resources region, 1990.

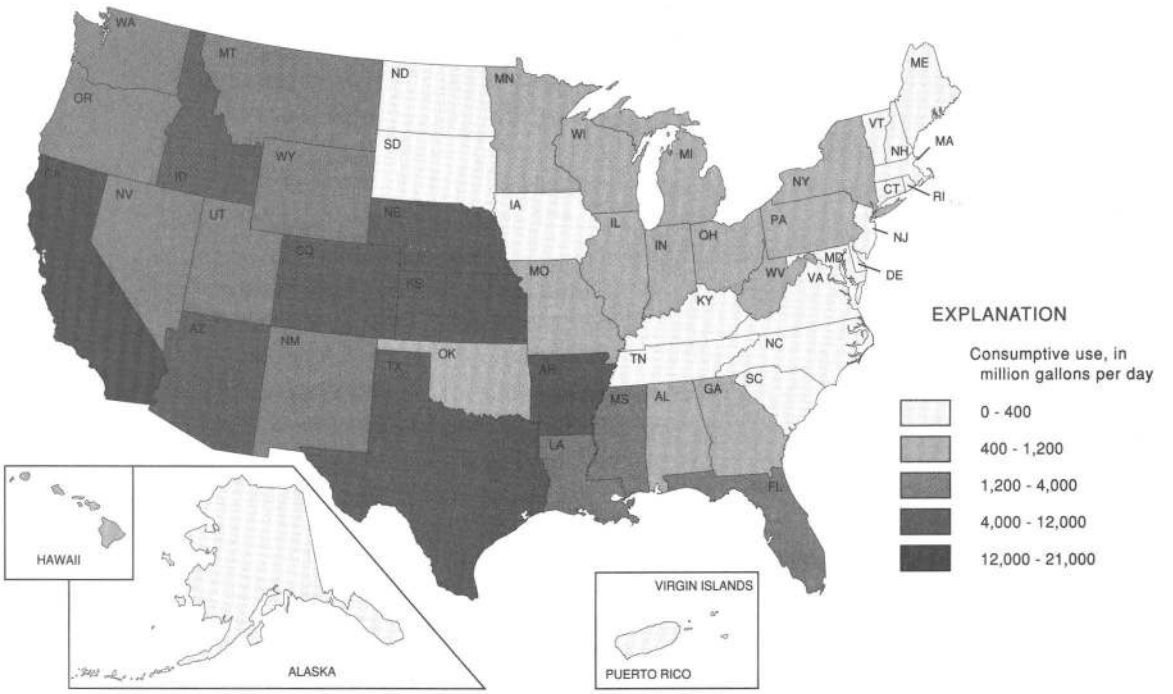



**Figure 4.** Freshwater consumptive use by State, 1990.

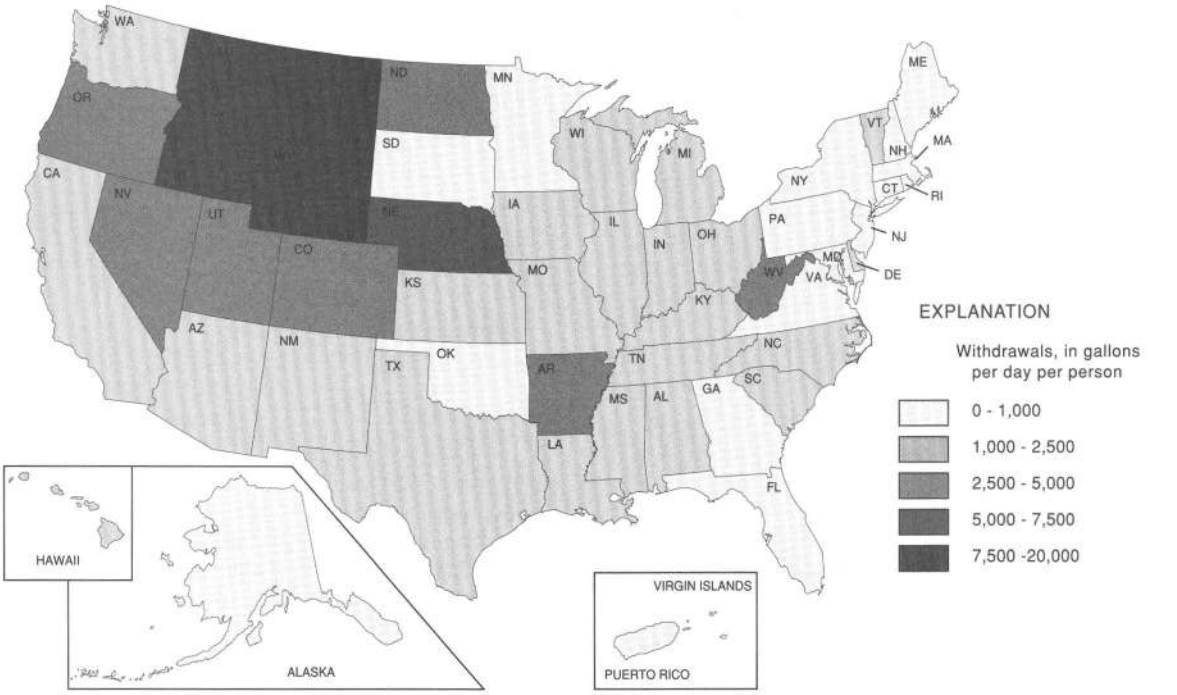



**Figure 5.** Intensity of freshwater withdrawals per capita by State, 1990.

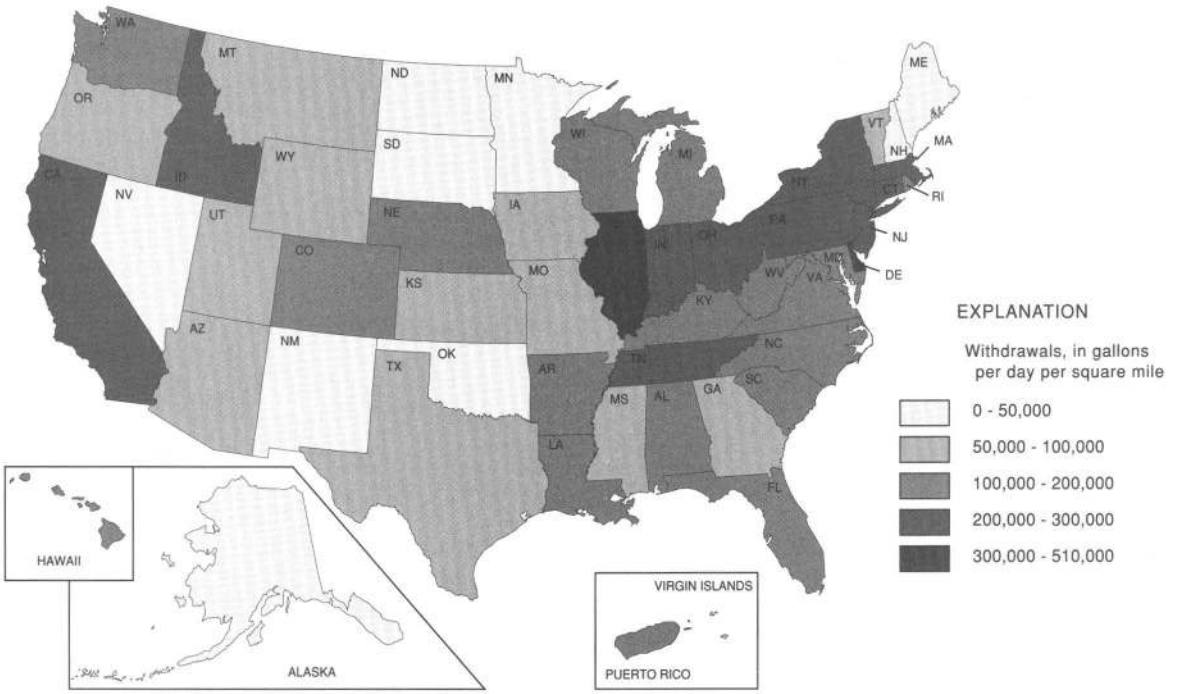



**Figure 6.** Intensity of freshwater withdrawals per area by State, 1990.

For an overview of how the 339,000 Mgal/d of freshwater withdrawn during 1990 was used, the eight offstream categories mentioned above have been combined into five major categories: public supply, domestic and commercial, irrigation and livestock, industrial and mining, and thermoelectric power. The source (withdrawals), use (withdrawals, deliveries), and disposition of freshwater for each category of use are summarized in figure 7. The source column shows the proportion of withdrawals by source and the distribution of withdrawals by water-use category. Source data indicate, for example, that surface water was the source of 259,000 Mgal/d of freshwater, or 76.5 percent of total freshwater withdrawals in the United States. Of the 259,000 Mgal/d of surface water, 50.2 percent was withdrawn directly for thermoelectric power. Public supply is considered a source of water and figure 7 shows the total quantity of water withdrawn by public supply, the percentage of surface and ground water withdrawn, and the percentage of water delivered to the other water-use categories. The use column shows total freshwater use for each category and the percentage each category represents of total offstream water use. In addition, the use column shows the proportion of the source (surface water, ground water, public supply) and disposition (consumptive use, return flow) for each category. The use data indicate, for example, that domestic and commercial use totaled 39,100 Mgal/d, (including losses in the public-supply distribution system), or 11.5 percent of the Nation's total freshwater withdrawals. Of this 39,100 Mgal/d, 85.2 percent was supplied by public-supply systems, and 82.7 percent was returned to a surface- or ground-water source after use. The disposition column shows the quantity of consumptive use and return flow after use. The disposition data indicate that of the total freshwater withdrawn, consumptive use was 94,000 Mgal/d, or 27.8 percent, and return flow was 245,000 Mgal/d, or 72.2 percent (including 27,500 Mgal/d of irrigation conveyance losses). Irrigation accounted for 84.3 percent of consumptive use and thermoelectric power accounted for 52.0 percent of return flow.

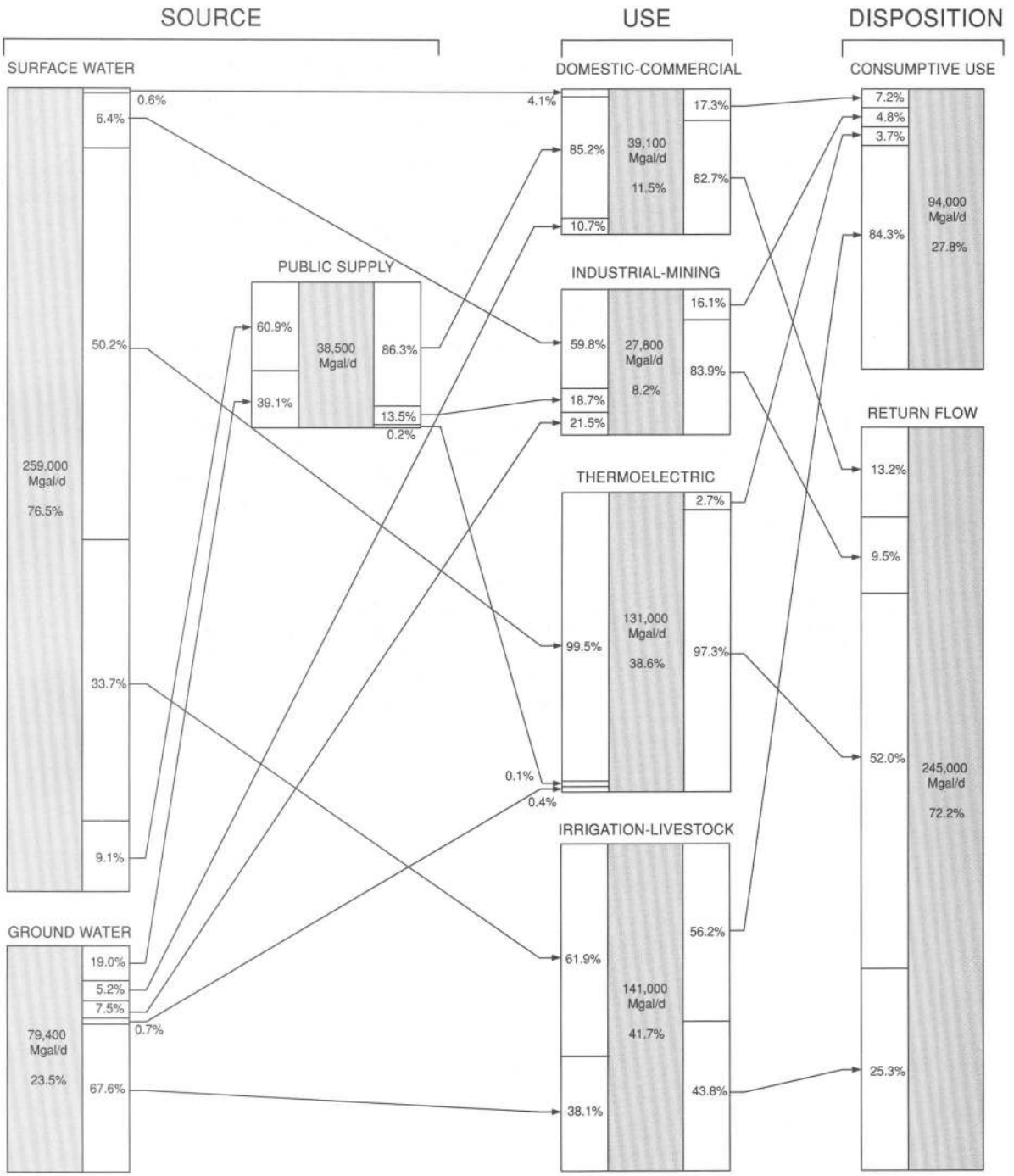



**Figure 7. Source, use, and disposition of freshwater in the United States, 1990.** For each water-use category, this diagram shows the relative proportion of water source and disposition and the general distribution of water from source to disposition. The lines and arrows indicate the distribution of water from source to disposition for each category; for example, surface water was 76.5 percent of total freshwater withdrawn, and going from "Source" to "Use" columns, the line from the surface-water block to the domestic and commercial block indicates that 0.6 percent of all surface water withdrawn was the source for 4.1 percent of total water (self-supplied withdrawals, public-supply deliveries) for domestic and commercial purposes. In addition, going from the "Use" to "Disposition" columns, the line from the domestic and commercial block to the consumptive use block indicates that 17.3 percent of the water for domestic and commercial purposes was consumptive use; this represents 7.2 percent of total consumptive use by all water-use categories.

# Public Supply

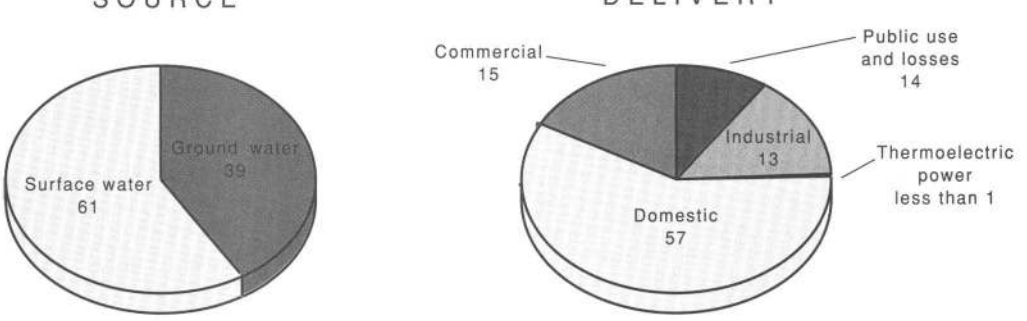
Public supply refers to water withdrawn by public and private water suppliers and delivered to multiple users for domestic, commercial, industrial, and thermoelectric power uses. In this report, public supply includes public and private water systems that furnish water to at least 25 people, or that have a minimum of 15 hookups. The difference in the quantity of water withdrawn by public suppliers in a water-resources region or State and the quantity of water delivered to all users represents losses in the collection and distribution systems, public use (water for firefighting, street washing, municipal parks, and swimming pools) and, in a few areas, water transferred between adjacent States or water-resources regions. These differences are shown in the chart below and in tables 9 and 10, as "Public use and losses".

Information on public supply generally was available from State health agencies and through State permitting offices. The U.S. Environmental Protection Agency's Public Drinking Water Supply file also was used as a reference. Data on population served and withdrawals usually are accurate because local and State agencies maintain relatively complete information. Deliveries from public suppliers to various users are more difficult to obtain and the information generally is less accurate.

The quantity of water withdrawn for public supply during 1990 was an estimated 38,500 Mgal/d (tables 9, 10), or 5 percent more than during 1985. Total public-supply withdrawals averaged 183 gal/d for each person served. Public-supply withdrawals represent 11 percent of total freshwater withdrawals for all offstream categories. Public suppliers served about 210 million people during 1990, (a 5-percent increase from 1985), or about 83 percent of the total population.

The source and delivery of water for public supply are shown in the chart below. Surface water was the source for about 61 percent of public-supply withdrawals. Ground water was the source for 39 percent of withdrawals, about the same as in 1985. Public-supply withdrawals were distributed to users as follows: domestic, 57 percent; commercial, 15 percent; industrial, 13 percent; and thermoelectric power, 0.2 percent. The remaining 14 percent of withdrawals represented public use and losses in the distribution system. Large positive values listed under "Public use and losses" in tables 9 and 10 may indicate, in addition to public use and losses, large exports of public-supply water to adjacent areas; negative values indicate imports of public-supply water from adjacent areas to the extent that public-supply deliveries in a region or in a State exceed public-supply withdrawals. This was the case in Washington, D.C., which imports public-supply water from Maryland.

Public-supply withdrawals in the Mid Atlantic, South Atlantic-Gulf, and California water-resources regions, three of the most populated regions, accounted for about 43 percent of total public-supply withdrawals (figure 8; table 9). Surface water was the source for 81 percent of public-supply withdrawals in the New England, Mid Atlantic, and Great Lakes regions. Ground water was the primary source in the South Atlantic-Gulf, Lower and Upper Mississippi, Rio Grande, and California regions. Ground water was the source for 93 percent of public-supply withdrawals in Hawaii. Public-supply withdrawals in California, New York, and Texas, the three most populous States (26 percent of the Nation's population), accounted for 31 percent of nationwide public-supply withdrawals (figure 9; table 10).




38,500 MILLION GALLONS PER DAY

PUBLIC–SUPPLY SOURCE AND DELIVERY, 1990, IN PERCENT

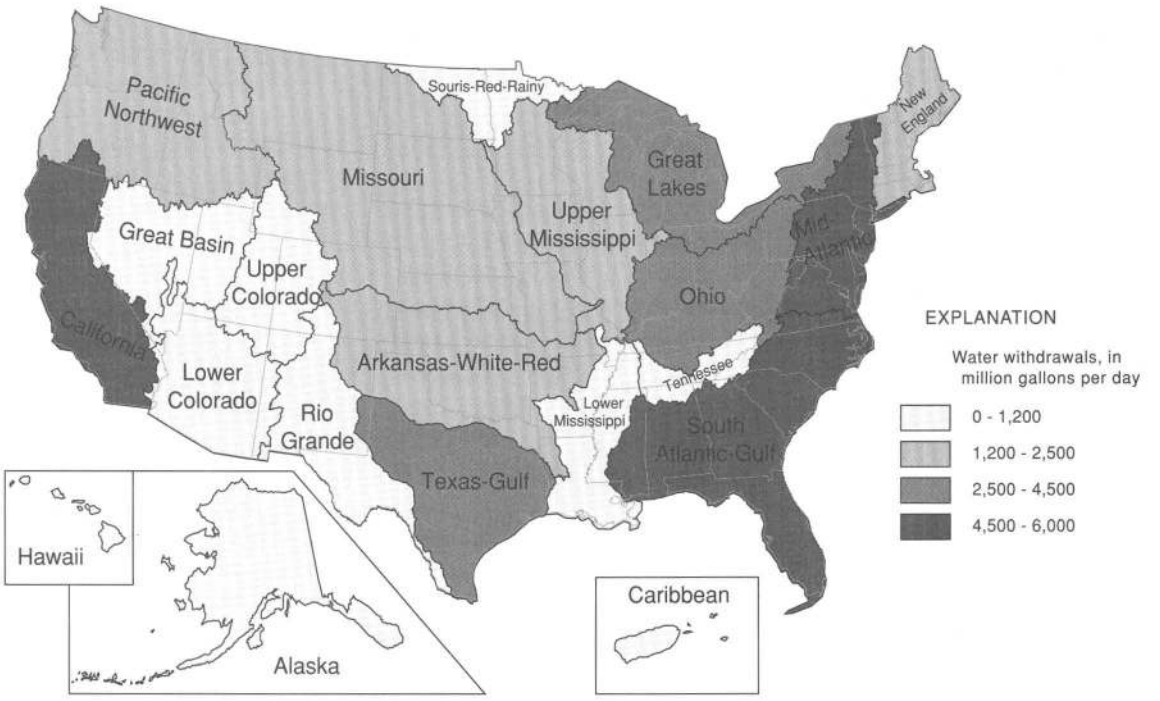



**Figure 8.** Public-supply freshwater withdrawals by water-resources region, 1990.

**Table 9.** Public-supply freshwater use by water-resources region, 1990

[Figures may not add to totals because of independent rounding. Mgal/d = million gallons per day; gal/d = gallons per day]

| REGION | POPULATION SERVED, in thousands | | | WATER WITHDRAWALS, in Mgal/d | | | PER CAPITA USE, in gal/d | WATER DELIVERIES, BY TYPE OF USE, in Mgal/d | | | | PUBLIC USE AND LOSSES[1] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Source | | | Source | | | | | | | | |
| | Ground water | Surface water | Total | Ground water | Surface water | Total | | Domestic | Commercial | Industrial | Thermoelectric power | |
| New England | 3,170 | 7,400 | 10,600 | 328 | 1,070 | 1,400 | 133 | 713 | 172 | 219 | 6.6 | 291 |
| Mid Atlantic | 10,700 | 24,400 | 35,100 | 1,400 | 4,580 | 5,980 | 171 | 3,270 | 937 | 672 | 1.1 | 1,100 |
| South Atlantic-Gulf | 15,600 | 12,100 | 27,700 | 2,510 | 2,340 | 4,850 | 175 | 2,790 | 746 | 855 | 6.1 | 458 |
| Great Lakes | 3,110 | 14,500 | 17,600 | 460 | 3,880 | 4,340 | 247 | 1,400 | 637 | 852 | .1 | 1,450 |
| Ohio | 5,960 | 10,500 | 16,500 | 774 | 1,750 | 2,530 | 153 | 1,050 | 411 | 615 | .9 | 450 |
| Tennessee | 757 | 2,270 | 3,030 | 109 | 402 | 511 | 169 | 252 | 111 | 94 | 0 | 55 |
| Upper Mississippi | 8,060 | 8,870 | 16,900 | 1,160 | 724 | 1,890 | 112 | 1,530 | 607 | 467 | 5.8 | -716 |
| Lower Mississippi | 4,300 | 1,640 | 5,940 | 701 | 334 | 1,040 | 174 | 698 | 150 | 70 | .7 | 117 |
| Souris-Red-Rainy | 239 | 222 | 461 | 34 | 37 | 72 | 156 | 45 | 11 | 3.4 | 0 | 12 |
| Missouri Basin | 3,430 | 4,920 | 8,350 | 612 | 1,010 | 1,620 | 194 | 925 | 270 | 112 | 7.0 | 307 |
| Arkansas-White-Red | 2,430 | 4,430 | 6,870 | 364 | 1,040 | 1,400 | 204 | 705 | 241 | 257 | 26 | 174 |
| Texas-Gulf | 6,310 | 8,230 | 14,500 | 1,050 | 1,470 | 2,520 | 173 | 2,060 | 113 | 143 | 7.1 | 197 |
| Rio Grande | 1,560 | 361 | 1,920 | 370 | 163 | 533 | 278 | 282 | 64 | 19 | 0 | 169 |
| Upper Colorado | 128 | 361 | 488 | 32 | 86 | 118 | 242 | 83 | 19 | 4.4 | 0 | 13 |
| Lower Colorado | 2,500 | 1,880 | 4,380 | 513 | 552 | 1,070 | 243 | 722 | 191 | 80 | .8 | 72 |
| Great Basin | 1,120 | 918 | 2,040 | 354 | 256 | 610 | 300 | 432 | 89 | 21 | 0 | 68 |
| Pacific Northwest | 3,220 | 3,860 | 7,080 | 727 | 850 | 1,580 | 223 | 960 | 202 | 175 | 0 | 239 |
| California | 13,500 | 11,800 | 25,200 | 3,210 | 2,530 | 5,750 | 228 | 3,690 | 780 | 495 | 13 | 773 |
| Alaska | 126 | 250 | 376 | 34 | 58 | 92 | 245 | 30 | 33 | 18 | 1.0 | 11 |
| Hawaii | 1,030 | 23 | 1,060 | 221 | 17 | 238 | 225 | 126 | 62 | 7.5 | .4 | 42 |
| Caribbean | 807 | 2,610 | 3,420 | 81 | 330 | 411 | 120 | 163 | 57 | 12 | 3.3 | 176 |
| Total | 88,000 | 122,000 | 210,000 | 15,100 | 23,500 | 38,500 | 184 | 21,900 | 5,900 | 5,190 | 80 | 5,460 |

[1] Includes transfers from adjacent areas.

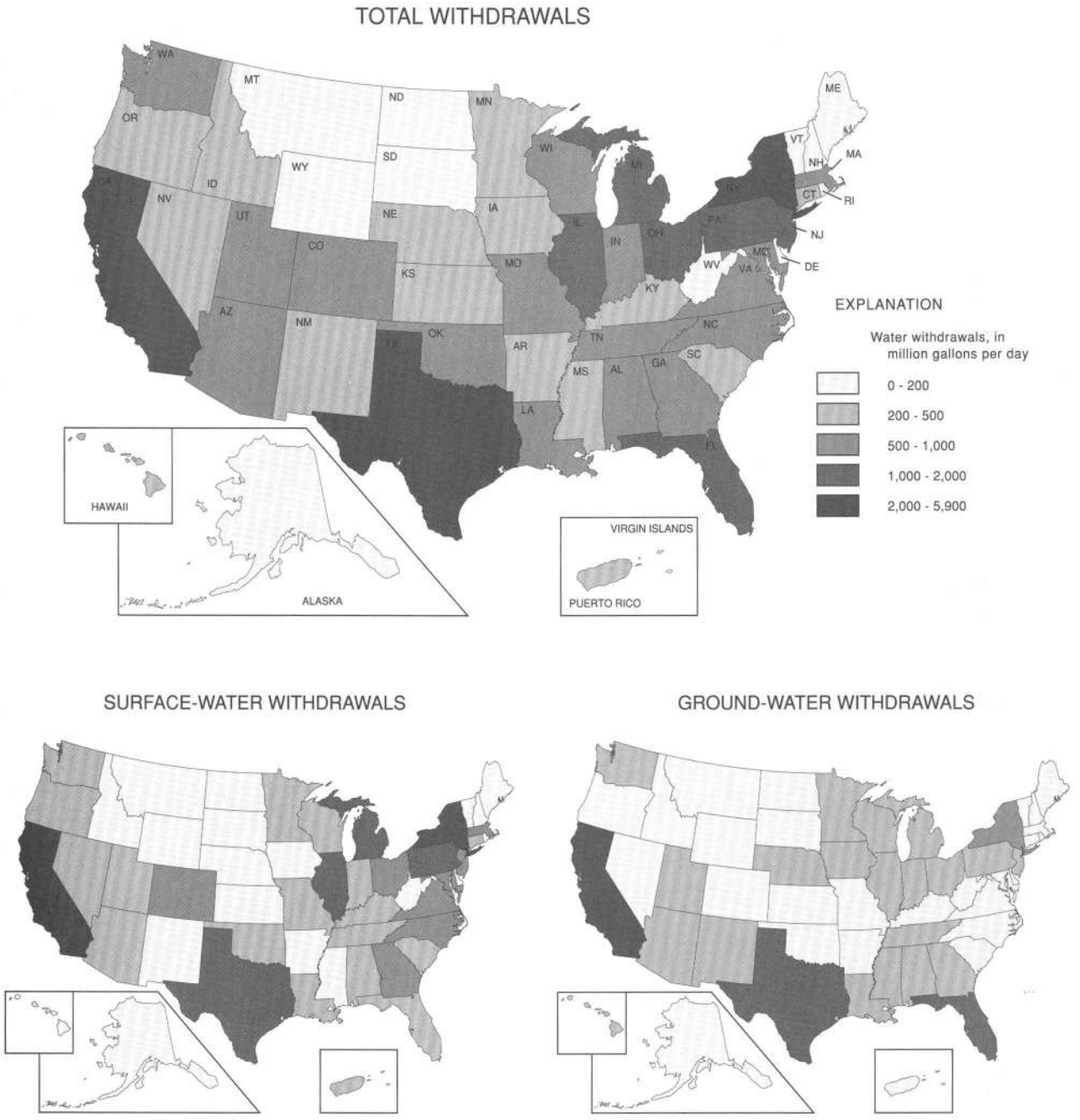



**Figure 9.** Public-supply freshwater withdrawals by source and State, 1990.

**Table 10.** Public-supply freshwater use by State, 1990

[Figures may not add to totals because of independent rounding. Mgal/d = million gallons per day; gal/d = gallons per day]

| STATE | POPULATION SERVED, in thousands | | | WATER WITHDRAWALS, in Mgal/d | | | PER CAPITA USE, in gal/d | WATER DELIVERIES, BY TYPE OF USE, in Mgal/d | | | | PUBLIC USE AND LOSSES[1] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Source | | | Source | | | | | | | | |
| | Ground water | Surface water | Total | Ground water | Surface water | Total | | Domestic | Commercial | Industrial | Thermoelectric power | |
| Alabama | 1,450 | 2,220 | 3,670 | 224 | 483 | 707 | 193 | 368 | 58 | 185 | 0.0 | 95 |
| Alaska | 126 | 250 | 376 | 34 | 58 | 92 | 245 | 30 | 33 | 18 | 1.0 | 11 |
| Arizona | 2,190 | 1,210 | 3,390 | 401 | 305 | 707 | 208 | 509 | 117 | 78 | 0 | 2.1 |
| Arkansas | 878 | 902 | 1,780 | 119 | 190 | 309 | 173 | 188 | 106 | .7 | 0 | 13 |
| California | 13,600 | 11,900 | 25,500 | 3,260 | 2,560 | 5,830 | 229 | 3,740 | 791 | 492 | 13 | 792 |
| Colorado | 422 | 2,620 | 3,050 | 83 | 567 | 650 | 213 | 441 | 108 | 21 | 13 | 68 |
| Connecticut | 514 | 2,160 | 2,670 | 73 | 301 | 374 | 140 | 188 | 51 | 64 | 2.6 | 69 |
| Delaware | 297 | 231 | 528 | 33 | 52 | 85 | 160 | 41 | 18 | 15 | .9 | 10 |
| D.C. | 0 | 607 | 607 | 0 | 0 | 0 | 256 | 109 | 47 | 0 | 0 | -155 |
| Florida | 10,000 | 1,210 | 11,200 | 1,700 | 226 | 1,930 | 171 | 1,250 | 282 | 183 | 5.5 | 207 |
| Georgia | 1,560 | 3,590 | 5,150 | 234 | 730 | 963 | 187 | 594 | 151 | 157 | 0 | 62 |
| Hawaii | 1,030 | 23 | 1,060 | 221 | 17 | 238 | 225 | 126 | 62 | 7.5 | .4 | 42 |
| Idaho | 626 | 143 | 768 | 173 | 28 | 201 | 262 | 143 | 6.1 | 3.8 | 0 | 48 |
| Illinois | 3,280 | 6,780 | 10,100 | 444 | 1,420 | 1,860 | 185 | 904 | 498 | 263 | 1.3 | 193 |
| Indiana | 1,960 | 2,030 | 3,990 | 274 | 330 | 604 | 151 | 303 | 102 | 105 | 0 | 94 |
| Iowa | 1,460 | 632 | 2,090 | 234 | 88 | 322 | 154 | 138 | 59 | 34 | 4.7 | 87 |
| Kansas | 1,040 | 1,190 | 2,230 | 176 | 197 | 373 | 167 | 192 | 77 | 35 | .8 | 69 |
| Kentucky | 332 | 2,240 | 2,570 | 55 | 372 | 427 | 166 | 179 | 23 | 199 | 0 | 26 |
| Louisiana | 1,840 | 1,770 | 3,610 | 275 | 344 | 619 | 171 | 448 | 54 | 32 | 0 | 84 |
| Maine | 162 | 527 | 689 | 21 | 86 | 106 | 154 | 40 | 24 | 17 | 1.2 | 24 |
| Maryland | 645 | 3,290 | 3,940 | 76 | 722 | 798 | 203 | 414 | 87 | 52 | 0 | 245 |
| Massachusetts | 2,010 | 3,500 | 5,500 | 179 | 535 | 714 | 130 | 365 | 58 | 108 | 2.8 | 181 |
| Michigan | 1,610 | 6,000 | 7,610 | 261 | 1,140 | 1,400 | 184 | 585 | 340 | 411 | 0 | 67 |
| Minnesota | 2,020 | 908 | 2,930 | 290 | 225 | 515 | 176 | 432 | 22 | 44 | .5 | 16 |
| Mississippi | 1,730 | 188 | 1,920 | 282 | 38 | 320 | 167 | 236 | 33 | 19 | .3 | 32 |
| Missouri | 1,500 | 2,590 | 4,090 | 185 | 493 | 677 | 166 | 348 | 59 | 133 | .2 | 137 |
| Montana | 221 | 374 | 595 | 51 | 83 | 135 | 226 | 77 | 25 | 1.0 | 0 | 32 |
| Nebraska | 975 | 226 | 1,200 | 235 | 66 | 301 | 251 | 138 | 50 | 33 | 1.9 | 78 |
| Nevada | 318 | 802 | 1,120 | 104 | 281 | 385 | 344 | 238 | 89 | 2.6 | .8 | 54 |
| New Hampshire | 300 | 394 | 694 | 34 | 61 | 95 | 137 | 49 | 17 | 15 | 0 | 14 |
| New Jersey | 2,710 | 4,110 | 6,820 | 396 | 643 | 1,040 | 152 | 511 | 140 | 241 | .2 | 146 |
| New Mexico | 1,050 | 156 | 1,210 | 241 | 32 | 273 | 226 | 163 | 68 | 15 | .1 | 26 |
| New York | 4,340 | 11,600 | 15,900 | 550 | 2,360 | 2,910 | 183 | 1,890 | 391 | 314 | 0 | 318 |
| North Carolina | 962 | 3,790 | 4,760 | 137 | 668 | 805 | 169 | 319 | 138 | 245 | .4 | 102 |
| North Dakota | 233 | 250 | 483 | 32 | 45 | 76 | 158 | 42 | 15 | 2.6 | 0 | 17 |
| Ohio | 3,160 | 5,900 | 9,060 | 396 | 904 | 1,300 | 143 | 455 | 325 | 325 | 0 | 194 |
| Oklahoma | 734 | 1,930 | 2,670 | 80 | 435 | 515 | 193 | 227 | 100 | 113 | 1.5 | 75 |
| Oregon | 513 | 1,710 | 2,220 | 105 | 365 | 470 | 212 | 246 | 67 | 81 | 0 | 76 |
| Pennsylvania | 3,230 | 5,920 | 9,160 | 427 | 1,300 | 1,730 | 189 | 570 | 205 | 248 | 0 | 705 |
| Rhode Island | 120 | 814 | 934 | 13 | 88 | 102 | 109 | 63 | 22 | 12 | 0 | 4.5 |
| South Carolina | 685 | 1,430 | 2,120 | 79 | 273 | 352 | 166 | 160 | 119 | 46 | 0 | 27 |
| South Dakota | 404 | 151 | 555 | 52 | 24 | 76 | 137 | 45 | 16 | 8.0 | 0 | 6.7 |
| Tennessee | 1,590 | 2,380 | 3,970 | 269 | 426 | 695 | 175 | 338 | 181 | 106 | .5 | 69 |
| Texas | 7,190 | 8,940 | 16,100 | 1,270 | 1,830 | 3,090 | 192 | 2,310 | 119 | 255 | 22 | 388 |
| Utah | 948 | 705 | 1,650 | 305 | 203 | 508 | 308 | 360 | 62 | 21 | 0 | 65 |
| Vermont | 173 | 160 | 333 | 19 | 19 | 39 | 116 | 27 | 3.1 | 3.1 | .1 | 5.8 |
| Virginia | 632 | 4,050 | 4,680 | 69 | 640 | 709 | 151 | 351 | 173 | 152 | 0 | 34 |
| Washington | 2,040 | 1,920 | 3,960 | 434 | 441 | 875 | 221 | 546 | 119 | 93 | 0 | 117 |
| West Virginia | 323 | 858 | 1,180 | 43 | 118 | 160 | 136 | 87 | 20 | 13 | .9 | 39 |
| Wisconsin | 1,900 | 1,510 | 3,410 | 294 | 301 | 595 | 175 | 179 | 99 | 151 | 0 | 167 |
| Wyoming | 160 | 180 | 340 | 41 | 47 | 88 | 260 | 55 | 16 | 5.5 | 0 | 11 |
| Puerto Rico | 799 | 2,570 | 3,370 | 80 | 325 | 404 | 120 | 162 | 55 | 12 | 2.8 | 173 |
| Virgin Islands | 7.5 | 37 | 44 | 1.0 | 5.4 | 6.4 | 144 | 1.0 | 2.1 | 0 | .5 | 2.8 |
| Total | 88,000 | 122,000 | 210,000 | 15,100 | 23,500 | 38,500 | 184 | 21,900 | 5,900 | 5,190 | 80 | 5,460 |

[1] Includes transfers from adjacent areas.

# Domestic

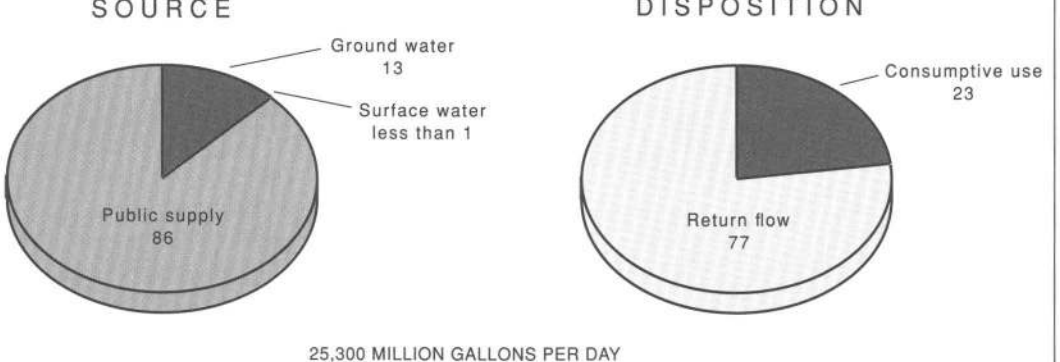
Domestic water use includes water for normal household purposes, such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, and watering lawns and gardens. State agencies generally obtain reliable information from public suppliers about withdrawals and population served. Information on deliveries to various users was more difficult to obtain and generally was estimated from the population served.

The number of people served by their own water systems (self supplied) was determined by subtracting the number of people served by public suppliers from the total population as reported by the U.S. Bureau of the Census. The difference between these totals indicated that 42.8 million people, or 17 percent of the Nation's total population, were served by their own water-supply systems in 1990, compared with 42.5 million people in 1985. Self-supplied domestic systems rarely are metered and few data exist. Self-supplied domestic withdrawals were estimated using per-capita use coefficients that generally ranged from 50 to 120 gallons per person per day. Consumptive use estimates were based on coefficients, generally ranging from 10 to 50 percent of withdrawals and deliveries.

Domestic water use (withdrawals, deliveries) during 1990 was an estimated 25,300 Mgal/d (tables 11, 12), or 4 percent more than during 1985. Domestic use represents 7 percent of total freshwater use for all offstream categories. Domestic withdrawals were an estimated 3,390 Mgal/d. Ground water was the source for about 96 percent of domestic withdrawals; surface water was the source for the remaining 4 percent. More than 50 percent of the Nation's population is dependent on ground water for domestic use. Withdrawals for the population served by their own water systems averaged about 79 gal/d for each person, compared to 78 gal/d during 1985. Public suppliers delivered about 21,900 Mgal/d of water to domestic users; this accounted for 57 percent of total public-supply withdrawals. Public-supply domestic deliveries averaged 105 gal/d for each person served, the same as during 1985. The per-capita use has remained about the same for the last decade as the result of active conservation programs in many states that include the installation of additional meters and water-conserving plumbing fixtures.

The source and disposition of water for domestic purposes are shown in the chart below. The consumptive use of water for domestic purposes during 1990 was 5,880 Mgal/d, or about 23 percent of withdrawals and deliveries.

In 1990, the South Atlantic-Gulf water-resources region had the largest self-supplied withdrawals for domestic purposes (figure 10), whereas the California region accounted for the largest total of domestic withdrawals and deliveries (table 11). Self-supplied domestic withdrawals were fairly evenly distributed among the States (figure 11). California, Texas, New York, Florida, and Illinois accounted for 44 percent of domestic water use because of large public-supply deliveries. (See figure 12; table 12.)




DOMESTIC SOURCE AND DISPOSITION, 1990, IN PERCENT

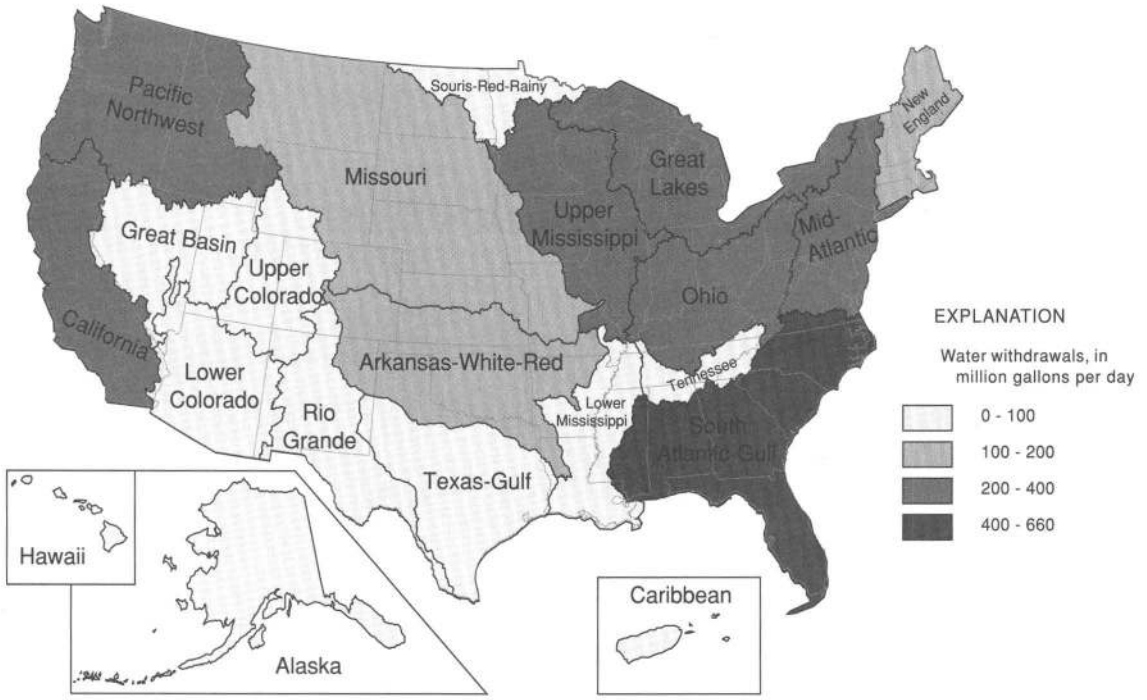



**Figure 10.** Domestic freshwater withdrawals by water-resources region, 1990.

**Table 11.** Domestic freshwater use by water-resources region, 1990

[Figures may not add to totals because of independent rounding. Mgal/d = million gallons per day; gal/d = gallons per day]

| REGION | SELF SUPPLIED | | | | | PUBLIC SUPPLY | | | TOTAL USE | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Population, in thousands | Water withdrawals, in Mgal/d | | | Per capita use, in gal/d | Population served, in thousands | Water deliveries, in Mgal/d | Per capita use, in gal/d | Withdrawals and deliveries, in Mgal/d | Consumptive use, in Mgal/d |
| | | Source | | Total | | | | | | |
| | | Ground water | Surface water | | | | | | | |
| New England | 2,220 | 169 | 0.0 | 169 | 76 | 10,600 | 713 | 67 | 882 | 124 |
| Mid Atlantic | 6,470 | 396 | .1 | 396 | 61 | 35,100 | 3,270 | 93 | 3,660 | 415 |
| South Atlantic-Gulf | 6,990 | 659 | 0 | 659 | 94 | 27,700 | 2,790 | 100 | 3,450 | 815 |
| Great Lakes | 3,820 | 282 | 1.0 | 283 | 74 | 17,600 | 1,400 | 80 | 1,690 | 235 |
| Ohio | 5,390 | 352 | 8.1 | 360 | 67 | 16,500 | 1,050 | 64 | 1,410 | 191 |
| Tennessee | 883 | 56 | 0 | 56 | 63 | 3,030 | 252 | 83 | 308 | 43 |
| Upper Mississippi | 4,340 | 371 | 0 | 371 | 85 | 16,900 | 1,530 | 90 | 1,900 | 401 |
| Lower Mississippi | 1,230 | 90 | 0 | 90 | 74 | 5,940 | 698 | 117 | 788 | 151 |
| Souris-Red-Rainy | 211 | 22 | 0 | 22 | 105 | 461 | 45 | 99 | 68 | 25 |
| Missouri Basin | 1,700 | 138 | 1.0 | 139 | 82 | 8,350 | 925 | 111 | 1,060 | 400 |
| Arkansas-White-Red | 1,380 | 118 | 0 | 118 | 85 | 6,870 | 705 | 103 | 823 | 267 |
| Texas-Gulf | 700 | 79 | 0 | 79 | 113 | 14,500 | 2,060 | 142 | 2,140 | 760 |
| Rio Grande | 311 | 23 | 0 | 23 | 75 | 1,920 | 282 | 147 | 305 | 142 |
| Upper Colorado | 137 | 9.9 | .3 | 10 | 74 | 488 | 83 | 169 | 93 | 34 |
| Lower Colorado | 363 | 37 | 2.1 | 39 | 108 | 4,380 | 722 | 165 | 761 | 363 |
| Great Basin | 145 | 13 | 2.6 | 15 | 106 | 2,040 | 432 | 212 | 448 | 165 |
| Pacific Northwest | 1,830 | 212 | 7.7 | 220 | 120 | 7,080 | 960 | 136 | 1,180 | 186 |
| California | 4,200 | 210 | 103 | 313 | 74 | 25,200 | 3,690 | 146 | 4,000 | 1,020 |
| Alaska | 174 | 6.2 | .7 | 6.9 | 40 | 376 | 30 | 79 | 36 | 3.7 |
| Hawaii | 53 | 8.5 | 1.4 | 9.9 | 189 | 1,060 | 126 | 119 | 136 | 68 |
| Caribbean | 208 | 3.7 | 4.6 | 8.2 | 40 | 3,420 | 163 | 48 | 171 | 74 |
| Total | 42,800 | 3,260 | 132 | 3,390 | 79 | 210,000 | 21,900 | 105 | 25,300 | 5,880 |

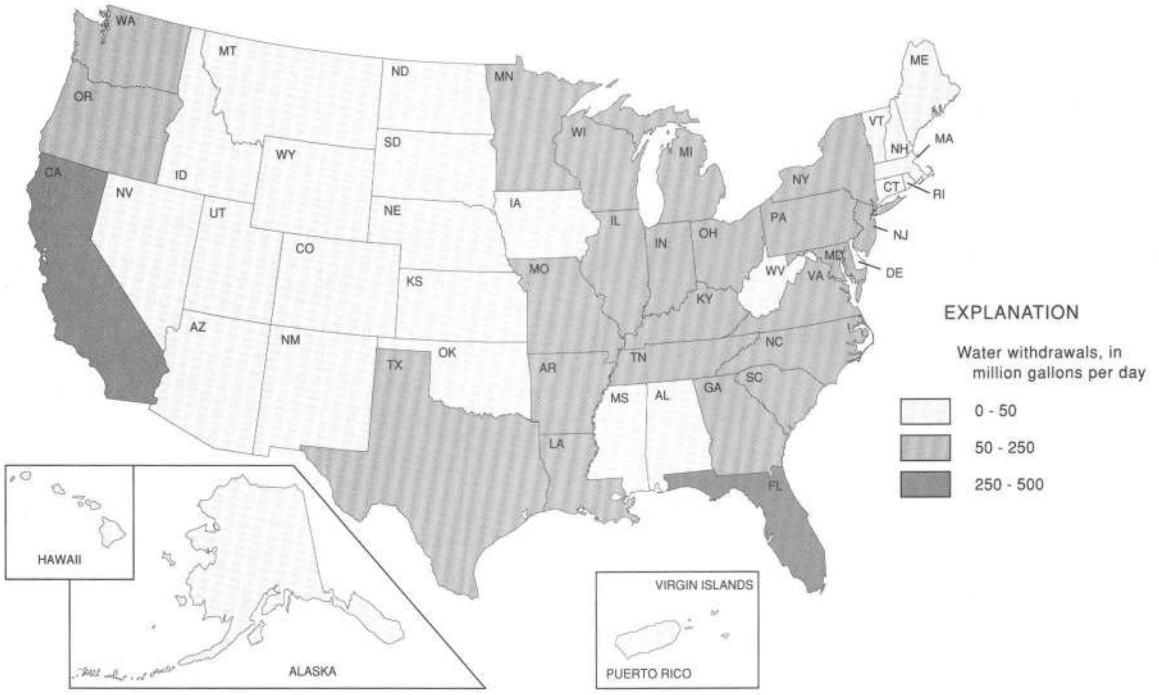



**Figure 11.** Domestic freshwater withdrawals by State, 1990.


**Figure 12.** Domestic freshwater use (withdrawals, deliveries) by State, 1990.

**Table 12.** Domestic freshwater use by State, 1990

[Figures may not add to totals because of independent rounding. Mgal/d = million gallons per day; gal/d = gallons per day]

| STATE | SELF SUPPLIED | | | | | PUBLIC SUPPLY | | | TOTAL USE | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Population, in thousands | Water withdrawals, in Mgal/d | | | Per capita use, in gal/d | Population served, in thousands | Water deliveries, in Mgal/d | Per capita use, in gal/d | Withdrawals and deliveries, in Mgal/d | Consumptive use, in Mgal/d |
| | | Source | | Total | | | | | | |
| | | Ground water | Surface water | | | | | | | |
| Alabama | 369 | 28 | 0.0 | 28 | 75 | 3,670 | 368 | 100 | 396 | 53 |
| Alaska | 174 | 6.2 | .7 | 6.9 | 40 | 376 | 30 | 79 | 36 | 3.7 |
| Arizona | 270 | 32 | .3 | 32 | 118 | 3,390 | 509 | 150 | 541 | 268 |
| Arkansas | 573 | 51 | 0 | 51 | 88 | 1,780 | 188 | 106 | 239 | 51 |
| California | 4,280 | 212 | 106 | 318 | 74 | 25,500 | 3,740 | 147 | 4,060 | 1,030 |
| Colorado | 248 | 19 | 0 | 19 | 76 | 3,050 | 441 | 145 | 460 | 139 |
| Connecticut | 616 | 46 | 0 | 46 | 75 | 2,670 | 188 | 70 | 234 | 47 |
| Delaware | 138 | 11 | 0 | 11 | 79 | 528 | 41 | 78 | 52 | 5.2 |
| D.C. | 0 | 0 | 0 | 0 | 0 | 607 | 109 | 179 | 109 | 11 |
| Florida | 1,710 | 299 | 0 | 299 | 175 | 11,200 | 1,250 | 111 | 1,550 | 434 |
| Georgia | 1,320 | 100 | 0 | 100 | 75 | 5,150 | 594 | 115 | 693 | 125 |
| Hawaii | 53 | 8.5 | 1.4 | 9.9 | 189 | 1,060 | 126 | 119 | 136 | 68 |
| Idaho | 238 | 48 | 0 | 48 | 200 | 768 | 143 | 186 | 191 | 3.7 |
| Illinois | 1,370 | 115 | 0 | 115 | 84 | 10,100 | 904 | 90 | 1,020 | 102 |
| Indiana | 1,550 | 118 | 0 | 118 | 76 | 3,990 | 303 | 76 | 421 | 63 |
| Iowa | 682 | 45 | 0 | 45 | 67 | 2,090 | 138 | 66 | 183 | 73 |
| Kansas | 250 | 25 | 0 | 25 | 100 | 2,230 | 192 | 86 | 217 | 115 |
| Kentucky | 1,120 | 50 | 5.5 | 56 | 50 | 2,570 | 179 | 70 | 235 | 41 |
| Louisiana | 607 | 50 | 0 | 50 | 83 | 3,610 | 448 | 124 | 498 | 100 |
| Maine | 539 | 49 | 0 | 49 | 90 | 689 | 40 | 58 | 88 | 13 |
| Maryland | 843 | 70 | 0 | 70 | 83 | 3,940 | 414 | 105 | 484 | 48 |
| Massachusetts | 512 | 37 | 0 | 37 | 72 | 5,500 | 365 | 66 | 402 | 40 |
| Michigan | 1,690 | 123 | .1 | 123 | 73 | 7,610 | 585 | 77 | 707 | 103 |
| Minnesota | 1,440 | 168 | 0 | 168 | 117 | 2,930 | 432 | 148 | 601 | 204 |
| Mississippi | 658 | 33 | 0 | 33 | 50 | 1,920 | 236 | 123 | 269 | 54 |
| Missouri | 1,030 | 62 | 0 | 62 | 60 | 4,090 | 348 | 85 | 410 | 114 |
| Montana | 204 | 15 | .8 | 16 | 78 | 595 | 77 | 129 | 93 | 44 |
| Nebraska | 378 | 47 | 0 | 47 | 125 | 1,200 | 138 | 115 | 185 | 103 |
| Nevada | 82 | 9.6 | .2 | 9.8 | 120 | 1,120 | 238 | 213 | 248 | 124 |
| New Hampshire | 415 | 27 | 0 | 27 | 65 | 694 | 49 | 71 | 76 | 11 |
| New Jersey | 911 | 68 | 0 | 68 | 75 | 6,820 | 511 | 75 | 580 | 106 |
| New Mexico | 308 | 24 | 0 | 24 | 78 | 1,210 | 163 | 135 | 187 | 109 |
| New York | 2,060 | 120 | 0 | 120 | 58 | 15,900 | 1,890 | 119 | 2,010 | 201 |
| North Carolina | 1,870 | 103 | 0 | 103 | 55 | 4,760 | 319 | 67 | 422 | 135 |
| North Dakota | 156 | 12 | 0 | 12 | 78 | 483 | 42 | 86 | 54 | 17 |
| Ohio | 1,790 | 131 | 2.7 | 134 | 75 | 9,060 | 455 | 50 | 589 | 88 |
| Oklahoma | 480 | 41 | 0 | 41 | 86 | 2,670 | 227 | 85 | 268 | 79 |
| Oregon | 622 | 57 | 7.6 | 64 | 104 | 2,220 | 246 | 111 | 311 | 81 |
| Pennsylvania | 2,720 | 141 | 0 | 141 | 52 | 9,160 | 570 | 62 | 711 | 71 |
| Rhode Island | 69 | 4.9 | 0 | 4.9 | 70 | 934 | 63 | 67 | 67 | 10 |
| South Carolina | 1,370 | 103 | 0 | 103 | 75 | 2,120 | 160 | 76 | 263 | 53 |
| South Dakota | 141 | 8.8 | 0 | 8.8 | 63 | 555 | 45 | 81 | 54 | 14 |
| Tennessee | 908 | 59 | 0 | 59 | 65 | 3,970 | 338 | 85 | 397 | 40 |
| Texas | 857 | 93 | 0 | 93 | 108 | 16,100 | 2,310 | 143 | 2,400 | 854 |
| Utah | 70 | 4.6 | 1.4 | 6.1 | 86 | 1,650 | 360 | 218 | 366 | 126 |
| Vermont | 230 | 17 | 0 | 17 | 72 | 333 | 27 | 80 | 43 | 6.5 |
| Virginia | 1,500 | 113 | 0 | 113 | 75 | 4,680 | 351 | 75 | 464 | 47 |
| Washington | 902 | 104 | 0 | 104 | 116 | 3,960 | 546 | 138 | 650 | 85 |
| West Virginia | 612 | 48 | 1.0 | 49 | 80 | 1,180 | 87 | 74 | 136 | 14 |
| Wisconsin | 1,490 | 90 | 0 | 90 | 61 | 3,410 | 179 | 52 | 269 | 54 |
| Wyoming | 114 | 8.1 | .4 | 8.5 | 75 | 340 | 55 | 163 | 64 | 25 |
| Puerto Rico | 150 | 3.5 | 3.2 | 6.7 | 44 | 3,370 | 162 | 48 | 168 | 74 |
| Virgin Islands | 57 | .2 | 1.4 | 1.6 | 28 | 44 | 1.0 | 23 | 2.6 | .6 |
| Total | 42,800 | 3,260 | 132 | 3,390 | 79 | 210,000 | 21,900 | 105 | 25,300 | 5,880 |

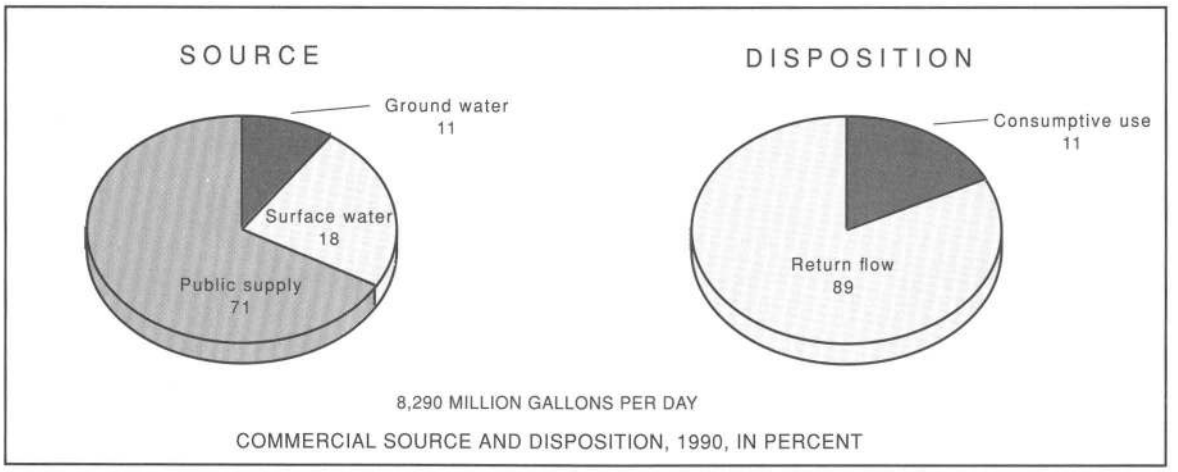
## Commercial

Commercial water use includes water for motels, hotels, restaurants, office buildings, other commercial facilities, and civilian and military institutions. A few States, such as Arkansas, Oregon, and California, have some offstream fish hatcheries that are included in the commercial category in this report. Most fish hatcheries are located instream and are not included in this compilation. Information on commercial withdrawals sometimes is available through State agencies that permit withdrawals or require permits to operate potable water supplies. In many cases, withdrawal estimates were based on the population of the commercial facilities; that is, the number of students attending a university, inmates in a penal institution, workers in an office building, or the average occupancy rate of a hotel. Information on deliveries from public suppliers to commercial users were estimated from a variety of methods if not available directly from public suppliers. Consumptive use estimates were based on coefficients generally ranging from 5 to 30 percent of withdrawals and deliveries.

Commercial water use (withdrawals, deliveries) during 1990 was an estimated 8,290 Mgal/d, or 19 percent more than during 1985. Over one-half of the increase occurred in Oregon, the result of including offstream fish hatcheries in this category. Commercial use represents about 2 percent of total freshwater use for all offstream categories. Commercial withdrawals were an estimated 2,390 Mgal/d. Surface water was the source for about 62 percent of commercial withdrawals. Public suppliers delivered about 5,900 Mgal/d of freshwater to commercial users during 1990; this accounted for about 15 percent of total public-supply withdrawals.

The source and disposition of water for commercial purposes are shown in the chart below. The consumptive use of water for commercial purposes during 1990 was about 885 Mgal/d, or 11 percent of withdrawals and deliveries.

The Pacific Northwest, California, and Upper Mississippi water-resources regions withdrew the most water for commercial purposes as shown in figure 13. These regions accounted for over 50 percent of withdrawals for commercial use (table 13). Oregon reported the largest self-supplied commercial withdrawals as shown in figure 14 and table 14. The large increase in Oregon was because offstream fish hatcheries were included in the commercial category for the first time. California, Oregon, and Illinois reported the most commercial water use (figure 15).




COMMERCIAL SOURCE AND DISPOSITION, 1990, IN PERCENT

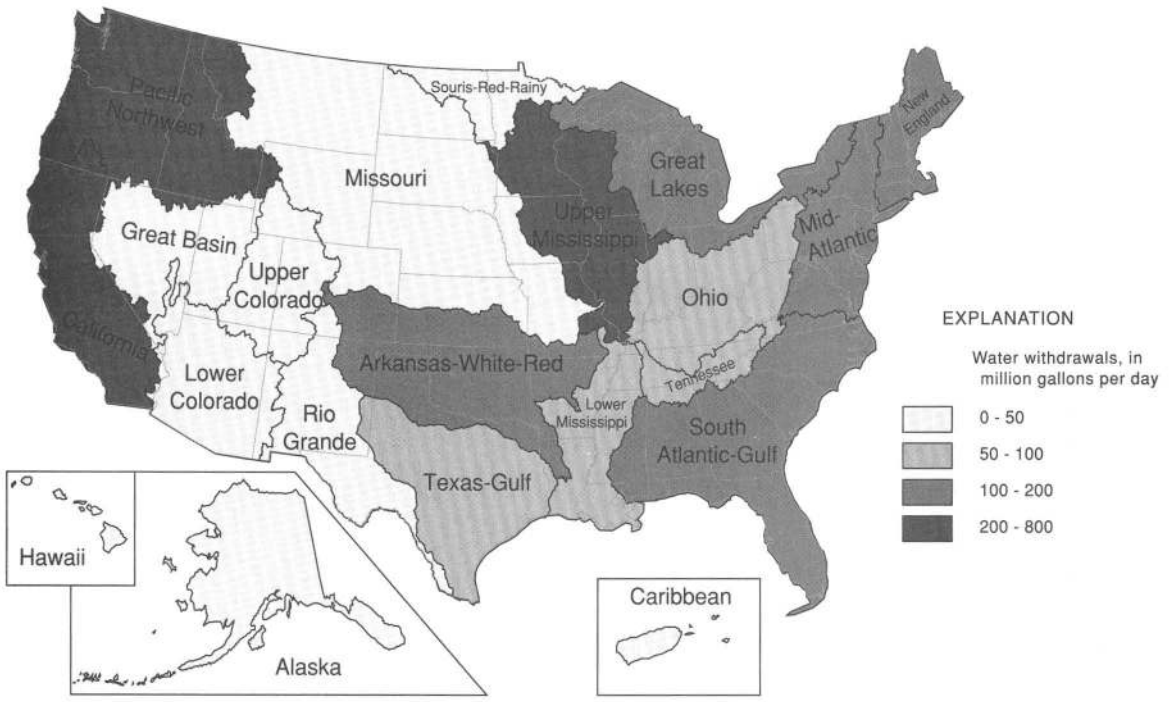



**Figure 13.** Commercial freshwater withdrawals by water-resources region, 1990.

**Table 13.** Commercial freshwater use by water-resources region, 1990

[Figures may not add to totals because of independent rounding. All values in million gallons per day]

| REGION | SELF-SUPPLIED WITHDRAWALS | | | PUBLIC-SUPPLY DELIVERIES | TOTAL USE | |
|---|---|---|---|---|---|---|
| | Source | | Total | | Withdrawals and deliveries | Consumptive use |
| | Ground water | Surface water | | | | |
| New England | 82 | 51 | 133 | 172 | 305 | 36 |
| Mid Atlantic | 94 | 39 | 133 | 937 | 1,070 | 101 |
| South Atlantic-Gulf | 120 | 14 | 134 | 746 | 880 | 121 |
| Great Lakes | 27 | 81 | 108 | 637 | 746 | 69 |
| Ohio | 58 | 31 | 89 | 411 | 500 | 52 |
| Tennessee | 56 | .2 | 56 | 111 | 167 | 16 |
| Upper Mississippi | 134 | 126 | 260 | 607 | 867 | 83 |
| Lower Mississippi | 20 | 72 | 92 | 150 | 242 | 29 |
| Souris-Red-Rainy | .1 | .2 | .3 | 11 | 11 | 1.0 |
| Missouri Basin | 33 | 6.4 | 40 | 270 | 309 | 63 |
| Arkansas-White-Red | 27 | 138 | 165 | 241 | 406 | 53 |
| Texas-Gulf | 47 | 11 | 57 | 113 | 170 | 14 |
| Rio Grande | 19 | 1.2 | 20 | 64 | 84 | 44 |
| Upper Colorado | 5.6 | .7 | 6.3 | 19 | 25 | 5.3 |
| Lower Colorado | 23 | 6.3 | 29 | 191 | 220 | 76 |
| Great Basin | 7.0 | 9.3 | 16 | 89 | 105 | 14 |
| Pacific Northwest | 49 | 669 | 718 | 202 | 920 | 52 |
| California | 58 | 213 | 271 | 780 | 1,050 | 7.8 |
| Alaska | 8.7 | 9.0 | 18 | 33 | 51 | 5.0 |
| Hawaii | 39 | .6 | 40 | 62 | 102 | 26 |
| Caribbean | .4 | .3 | .8 | 57 | 58 | 18 |
| Total | 908 | 1,480 | 2,390 | 5,900 | 8,290 | 885 |

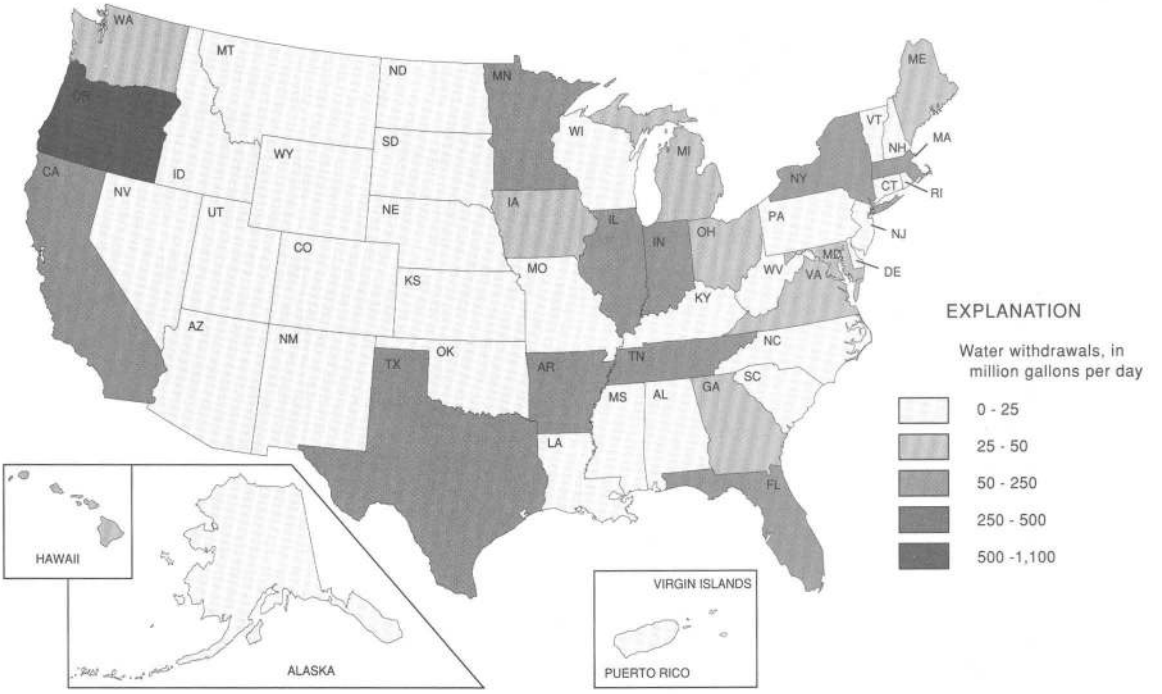



**Figure 14.** Commercial freshwater withdrawals by State, 1990.


**Figure 15.** Commercial freshwater use (withdrawals, deliveries) by State, 1990.

**Table 14.** Commercial freshwater use by State, 1990

[Figures may not add to totals because of independent rounding. All values in million gallons per day]

| STATE | SELF-SUPPLIED WITHDRAWALS | | | PUBLIC-SUPPLY DELIVERIES | TOTAL USE | |
|---|---|---|---|---|---|---|
| | Source | | Total | | Withdrawals and deliveries | Consumptive use |
| | Ground water | Surface water | | | | |
| Alabama | 3.1 | 0.3 | 3.5 | 58 | 61 | 13 |
| Alaska | 8.7 | 9.0 | 18 | 33 | 51 | 5.0 |
| Arizona | 18 | 0 | 18 | 117 | 135 | 61 |
| Arkansas | 14 | 207 | 222 | 106 | 328 | 38 |
| California | 57 | 177 | 234 | 791 | 1,020 | 7.1 |
| Colorado | 7.7 | .9 | 8.6 | 108 | 116 | 17 |
| Connecticut | 18 | .6 | 18 | 51 | 69 | 13 |
| Delaware | 1.8 | 0 | 1.8 | 18 | 20 | 2.0 |
| D.C. | 0 | 0 | 0 | 47 | 47 | 4.7 |
| Florida | 50 | 1.5 | 52 | 282 | 334 | 35 |
| Georgia | 30 | 12 | 42 | 151 | 192 | 35 |
| Hawaii | 39 | .6 | 40 | 62 | 102 | 26 |
| Idaho | 16 | 0 | 16 | 6.1 | 22 | 1.1 |
| Illinois | 54 | 119 | 173 | 498 | 672 | 54 |
| Indiana | 33 | 31 | 63 | 102 | 165 | 25 |
| Iowa | 19 | 8.0 | 27 | 59 | 86 | 11 |
| Kansas | 6.2 | 0 | 6.2 | 77 | 83 | 33 |
| Kentucky | 4.2 | 9.2 | 13 | 23 | 37 | 1.3 |
| Louisiana | 12 | .9 | 13 | 54 | 67 | 10 |
| Maine | 3.6 | 30 | 34 | 24 | 58 | 5.5 |
| Maryland | 19 | 6.4 | 26 | 87 | 113 | 11 |
| Massachusetts | 55 | 18 | 74 | 58 | 132 | 13 |
| Michigan | 8.1 | 27 | 35 | 340 | 375 | 30 |
| Minnesota | 56 | 16 | 71 | 22 | 93 | 12 |
| Mississippi | 16 | 0 | 16 | 33 | 48 | 8.2 |
| Missouri | 22 | 0 | 22 | 59 | 81 | 5.5 |
| Montana | 0 | 0 | 0 | 25 | 25 | 9.1 |
| Nebraska | .2 | 0 | .2 | 50 | 50 | 16 |
| Nevada | 7.1 | 16 | 23 | 89 | 112 | 20 |
| New Hampshire | .4 | .2 | .6 | 17 | 17 | 1.9 |
| New Jersey | 15 | 1.4 | 17 | 140 | 157 | 6.3 |
| New Mexico | 16 | 1.2 | 17 | 68 | 86 | 51 |
| New York | 29 | 32 | 61 | 391 | 452 | 45 |
| North Carolina | 17 | 0 | 17 | 138 | 155 | 17 |
| North Dakota | .1 | 0 | .1 | 15 | 16 | 2.5 |
| Ohio | 25 | 11 | 36 | 325 | 361 | 30 |
| Oklahoma | 4.8 | 1.5 | 6.3 | 100 | 106 | 7.7 |
| Oregon | 7.3 | 704 | 711 | 67 | 778 | 18 |
| Pennsylvania | 14 | 10 | 24 | 205 | 229 | 23 |
| Rhode Island | 4.2 | 1.3 | 5.6 | 22 | 28 | 2.7 |
| South Carolina | 2.1 | 0 | 2.1 | 119 | 121 | 18 |
| South Dakota | 12 | 4.6 | 17 | 16 | 33 | 3.2 |
| Tennessee | 55 | 0 | 55 | 181 | 236 | 21 |
| Texas | 51 | 11 | 62 | 119 | 181 | 8.9 |
| Utah | 4.2 | 0 | 4.2 | 62 | 66 | 8.7 |
| Vermont | 2.8 | 1.0 | 3.8 | 3.1 | 6.9 | .9 |
| Virginia | 27 | 8.3 | 35 | 173 | 208 | 25 |
| Washington | 27 | .4 | 27 | 119 | 146 | 29 |
| West Virginia | 2.5 | .6 | 3.1 | 20 | 23 | 2.3 |
| Wisconsin | 11 | 0 | 11 | 99 | 110 | 22 |
| Wyoming | .9 | .7 | 1.6 | 16 | 18 | 2.7 |
| Puerto Rico | .1 | 0 | .1 | 55 | 56 | 18 |
| Virgin Islands | .4 | .3 | .7 | 2.1 | 2.8 | .4 |
| Total | 908 | 1,480 | 2,390 | 5,900 | 8,290 | 885 |

# Irrigation

Irrigation water use includes all water artificially applied to farm and horticultural crops as well as water used to irrigate public and private golf courses. Irrigation water can be self supplied or supplied by irrigation companies or districts. However, all irrigation withdrawals in this report are identified as self-supplied withdrawals.

Irrigation of crops developed concurrently with the settlement of the arid West, where natural precipitation was insufficient to raise many crops. In the humid eastern States, irrigation has been used to supplement natural precipitation to increase the number of plantings per year or the yields of crops, and to reduce the risk of crop failures during droughts.

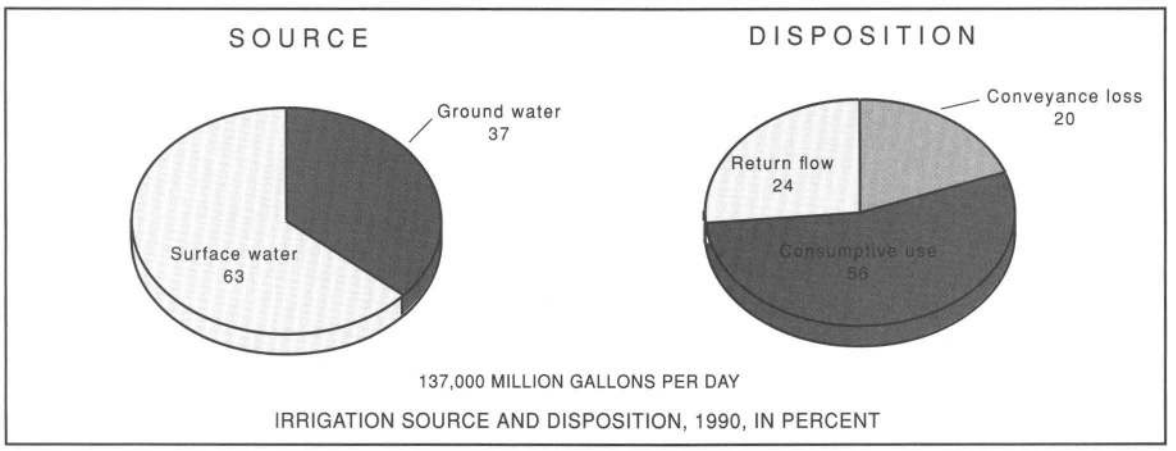
Information about the number of acres irrigated and the quantity of water withdrawn was obtained from a variety of sources such as State agencies responsible for permitting or allocating the withdrawal of water, the U.S. Soil Conservation Service, U.S. Bureau of Reclamation, county Cooperative Extension Service, individual farmers, agricultural research stations, and the U.S. Bureau of the Census, Agricultural Census, and Farm and Ranch Survey. Total acres irrigated are reported in two classes—spray irrigation (includes center pivot, travelling gun, trickle, and drip) and flood irrigation (includes flooding, furrow, and ditch).

Methods of estimating withdrawals for irrigation varied greatly. In some instances, they were based on theoretical estimates of water required to raise a given crop in an area. In other instances, accurate records of water application rates were available. Fairly accurate estimates of water withdrawn for irrigation can be made if the acreage irrigated, water application rates, and conveyance losses are known. It usually is difficult to obtain reliable estimates for consumptive use and for conveyance loss. Thus, some of the estimates of consumptive use and conveyance loss may be only rough approximations of actual conditions. In most States, consumptive use was based on coefficients ranging from 40 to 100 percent of withdrawals, or on theoretical crop requirements. In a few States, consumptive use was calculated as the difference between reported withdrawals and reported return flows.

The quantity of water withdrawn for irrigation during 1990 was an estimated 137,000 Mgal/d or 153 million acre-feet. (See tables 15, 16.) Irrigation withdrawals as well as acres irrigated during 1990 were about the same as during 1985. Irrigation use represents 40 percent of total freshwater use for all offstream categories.

The source and disposition of water for irrigation are shown in the chart below. Surface water was the source for about 63 percent of irrigation withdrawals, and, except for a small fraction of 1 percent that was reclaimed wastewater, ground water furnished the remainder. Surface-water withdrawals for irrigation during 1990 were about 6 percent less than during 1985, and ground-water withdrawals for irrigation during 1990 were about 12 percent more than during 1985. Of the 137,000 Mgal/d withdrawn for irrigation, 20 percent was lost in conveyance, 56 percent was consumptive use, and 24 percent was returned to surface- or ground-water supplies.

Irrigation is by far the largest water use in the West. The nine western water-resources regions (excluding Alaska and Hawaii), led by the Pacific Northwest region, accounted for 90 percent of the total water withdrawn for irrigation during 1990 (figure 16; table 15). In the eastern regions, most of the water withdrawn for irrigation was in the Lower Mississippi and South Atlantic-Gulf regions, which together had about 2,400 Mgal/d more water withdrawn during 1990 than during 1985. By State, California and Idaho were by far the largest users of irrigation water (figure 17) and, together, accounted for 34 percent of the national total (table 16). Florida withdrew the most water for irrigation in the East although it ranked thirteenth nationwide.




IRRIGATION SOURCE AND DISPOSITION, 1990, IN PERCENT

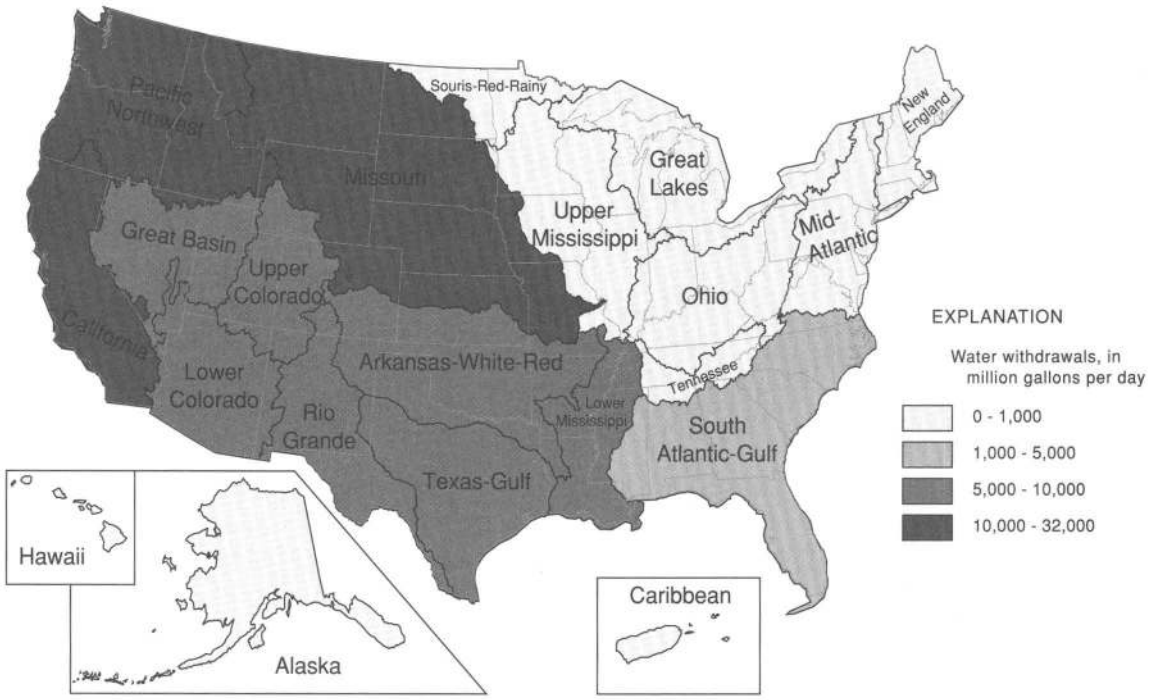



**Figure 16.** Irrigation freshwater withdrawals by water-resources region, 1990.

**Table 15.** Irrigation water use by water-resources region, 1990

[Figures may not add to totals because of independent rounding]

| REGION | IRRIGATED LAND BY TYPE, in thousand acres | | THOUSAND ACRE-FEET PER YEAR | | | | | | MILLION GALLONS PER DAY | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Withdrawals, by source | | | Reclaimed waste-water | Convey-ance losses | Consump-tive use, fresh-water | Withdrawals, by source | | | Convey-ance losses | Consump-tive use, fresh water |
| | | | Freshwater | | Total | | | | Freshwater | | Total | | |
| | Spray | Flood | Ground | Surface | | | | | Ground | Surface | | | |
| New England | 49 | 12 | 9.9 | 124 | 134 | 0.0 | 0.0 | 134 | 8.8 | 111 | 120 | 0.0 | 120 |
| Mid Atlantic | 347 | 3.6 | 114 | 106 | 221 | 0 | 2.8 | 188 | 102 | 95 | 197 | 2.5 | 168 |
| South Atlantic-Gulf | 2,660 | 1,140 | 2,580 | 2,420 | 4,990 | 264 | 76 | 3,570 | 2,300 | 2,160 | 4,450 | 68 | 3,180 |
| Great Lakes | 537 | .9 | 148 | 177 | 325 | 0 | 0 | 308 | 132 | 158 | 290 | 0 | 274 |
| Ohio | 166 | .5 | 31 | 45 | 76 | .3 | .6 | 67 | 28 | 40 | 68 | .5 | 59 |
| Tennessee | 31 | .1 | 4.2 | 26 | 30 | .4 | 0 | 21 | 3.8 | 23 | 27 | 0 | 19 |
| Upper Mississippi | 838 | 11 | 397 | 42 | 440 | .1 | .1 | 408 | 354 | 38 | 392 | .1 | 364 |
| Lower Mississippi | 977 | 3,800 | 6,990 | 1,290 | 8,280 | .8 | 672 | 6,160 | 6,230 | 1,150 | 7,380 | 600 | 5,490 |
| Souris-Red-Rainy | 98 | 22 | 63 | 47 | 110 | 0 | 1.2 | 98 | 56 | 42 | 98 | 1.1 | 87 |
| Missouri Basin | 4,880 | 7,950 | 8,070 | 19,700 | 27,800 | 3.4 | 10,100 | 12,300 | 7,200 | 17,600 | 24,800 | 9,010 | 10,900 |
| Arkansas-White-Red | 2,270 | 3,520 | 7,400 | 2,010 | 9,410 | 10 | 891 | 7,750 | 6,600 | 1,790 | 8,390 | 794 | 6,910 |
| Texas-Gulf | 1,710 | 2,680 | 4,450 | 1,270 | 5,720 | 34 | 383 | 4,820 | 3,970 | 1,130 | 5,100 | 342 | 4,300 |
| Rio Grande | 354 | 1,030 | 1,810 | 4,120 | 5,930 | .7 | 1,200 | 3,570 | 1,620 | 3,670 | 5,290 | 1,070 | 3,180 |
| Upper Colorado | 233 | 1,330 | 36 | 7,350 | 7,390 | .5 | 1,790 | 2,510 | 32 | 6,560 | 6,590 | 1,600 | 2,240 |
| Lower Colorado | 427 | 1,100 | 2,510 | 4,280 | 6,800 | 205 | 1,210 | 4,560 | 2,240 | 3,820 | 6,060 | 1,080 | 4,070 |
| Great Basin | 570 | 1,370 | 1,580 | 5,480 | 7,060 | 58 | 1,530 | 3,490 | 1,410 | 4,890 | 6,300 | 1,360 | 3,110 |
| Pacific Northwest | 4,210 | 3,280 | 8,800 | 26,800 | 35,600 | 12 | 10,800 | 13,100 | 7,850 | 23,900 | 31,800 | 9,670 | 11,700 |
| California | 2,310 | 7,300 | 11,900 | 19,800 | 31,700 | 143 | 1,960 | 21,700 | 10,600 | 17,700 | 28,300 | 1,750 | 19,400 |
| Alaska | 1.4 | 0 | .1 | .5 | .6 | 0 | .1 | .3 | .1 | .5 | .6 | .1 | .3 |
| Hawaii | 115 | 12 | 224 | 622 | 846 | 6.9 | 143 | 586 | 200 | 555 | 755 | 127 | 523 |
| Caribbean | 21 | 14 | 60 | 97 | 157 | 0 | 19 | 102 | 54 | 87 | 140 | 17 | 91 |
| Total | 22,800 | 34,600 | 57,200 | 95,900 | 153,000 | 740 | 30,800 | 85,400 | 51,000 | 85,500 | 137,000 | 27,500 | 76,200 |

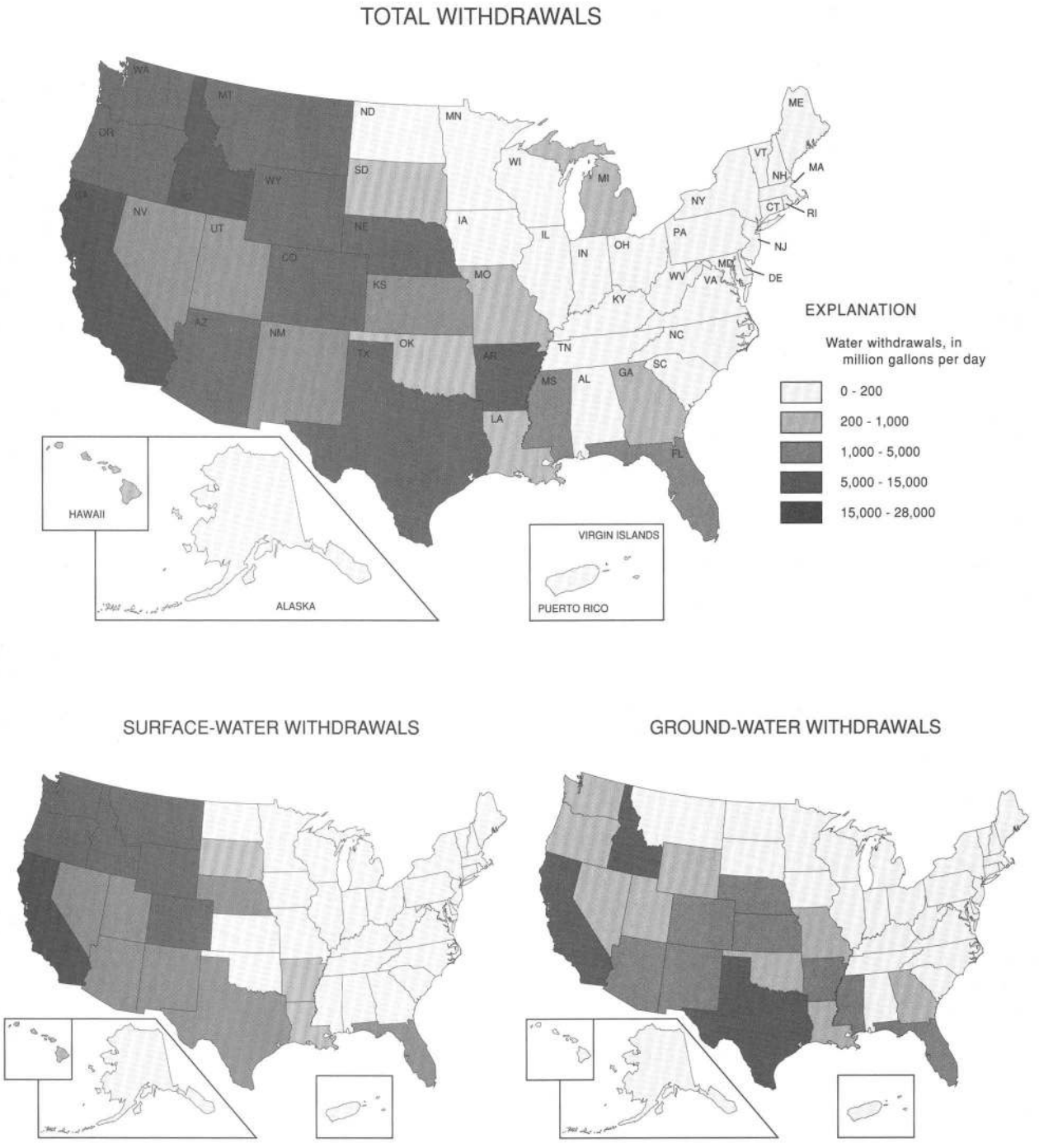



**Figure 17.** Irrigation freshwater withdrawals by source and State, 1990.

**Table 16.** Irrigation water use by State, 1990

[Figures may not add to totals because of independent rounding]

| STATE | IRRIGATED LAND BY TYPE, in thousand acres | | THOUSAND ACRE-FEET PER YEAR | | | | | | MILLION GALLONS PER DAY | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Withdrawals, by source | | | Reclaimed waste-water | Convey-ance losses | Consump-tive use, fresh-water | Withdrawals, by source | | | Convey-ance losses | Consump-tive use, fresh water |
| | | | Freshwater | | Total | | | | Freshwater | | Total | | |
| | Spray | Flood | Ground | Surface | | | | | Ground | Surface | | | |
| Alabama | 147 | 0.0 | 37 | 69 | 106 | 0.0 | 0.0 | 79 | 33 | 62 | 94 | 0.0 | 71 |
| Alaska | 1.4 | 0 | .1 | .5 | .6 | 0 | .1 | .3 | .1 | .5 | .6 | .1 | .3 |
| Arizona | 409 | 940 | 2,300 | 3,640 | 5,940 | 202 | 1,130 | 3,990 | 2,060 | 3,250 | 5,300 | 1,010 | 3,560 |
| Arkansas | 297 | 2,680 | 4,820 | 1,060 | 5,880 | 0 | 412 | 4,360 | 4,300 | 949 | 5,250 | 368 | 3,890 |
| California | 2,230 | 7,250 | 12,000 | 19,300 | 31,200 | 148 | 1,750 | 21,800 | 10,700 | 17,200 | 27,900 | 1,560 | 19,500 |
| Colorado | 897 | 2,660 | 2,870 | 10,100 | 13,000 | 4.2 | 3,350 | 5,560 | 2,560 | 9,000 | 11,600 | 2,990 | 4,960 |
| Connecticut | 28 | 0 | 9.2 | 7.3 | 17 | 0 | 0 | 17 | 8.2 | 6.5 | 15 | 0 | 15 |
| Delaware | 64 | 0 | 26 | 11 | 36 | 0 | 0 | 36 | 23 | 9.5 | 32 | 0 | 32 |
| D.C. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Florida | 1,020 | 1,130 | 2,180 | 2,000 | 4,180 | 190 | 72 | 2,780 | 1,940 | 1,780 | 3,730 | 64 | 2,480 |
| Georgia | 1,180 | 0 | 294 | 199 | 494 | 39 | 0 | 494 | 263 | 178 | 441 | 0 | 441 |
| Hawaii | 115 | 12 | 224 | 622 | 846 | 6.9 | 143 | 586 | 200 | 555 | 755 | 127 | 523 |
| Idaho | 1,540 | 1,870 | 7,420 | 13,500 | 20,900 | 0 | 8,020 | 6,810 | 6,620 | 12,100 | 18,700 | 7,160 | 6,070 |
| Illinois | 287 | 0 | 84 | 4.2 | 88 | .1 | 0 | 79 | 75 | 3.7 | 78 | 0 | 70 |
| Indiana | 169 | 0 | 22 | 35 | 57 | 0 | 0 | 51 | 20 | 31 | 51 | 0 | 46 |
| Iowa | 74 | 0 | 24 | 1.6 | 25 | 0 | 0 | 25 | 21 | 1.4 | 23 | 0 | 23 |
| Kansas | 1,450 | 1,660 | 4,470 | 224 | 4,690 | 6.2 | 163 | 4,530 | 3,990 | 199 | 4,190 | 146 | 4,040 |
| Kentucky | 32 | .7 | .5 | 12 | 13 | 0 | .5 | 12 | .5 | 11 | 12 | .5 | 11 |
| Louisiana | 193 | 496 | 506 | 287 | 793 | 0 | 101 | 693 | 451 | 256 | 708 | 90 | 618 |
| Maine | 5.1 | 0 | .2 | 1.8 | 2.0 | 0 | 0 | 2.0 | .2 | 1.6 | 1.8 | 0 | 1.8 |
| Maryland | 64 | 0 | 22 | 11 | 33 | 0 | 0 | 33 | 19 | 10 | 29 | 0 | 29 |
| Massachusetts | 6.4 | 12 | 0 | 112 | 112 | 0 | 0 | 112 | 0 | 100 | 100 | 0 | 100 |
| Michigan | 367 | 0 | 118 | 151 | 269 | 0 | 0 | 255 | 105 | 135 | 240 | 0 | 227 |
| Minnesota | 349 | 17 | 176 | 43 | 219 | 0 | 0 | 196 | 157 | 38 | 195 | 0 | 175 |
| Mississippi | 449 | 728 | 1,970 | 146 | 2,110 | 1.1 | 211 | 1,490 | 1,750 | 130 | 1,880 | 188 | 1,330 |
| Missouri | 228 | 323 | 376 | 40 | 416 | 0 | 0 | 301 | 335 | 36 | 371 | 0 | 269 |
| Montana | 597 | 1,340 | 101 | 9,990 | 10,100 | 0 | 5,180 | 2,170 | 90 | 8,910 | 9,000 | 4,620 | 1,940 |
| Nebraska | 3,000 | 3,860 | 4,880 | 1,950 | 6,840 | 0 | 2,420 | 4,410 | 4,360 | 1,740 | 6,100 | 2,160 | 3,930 |
| Nevada | 155 | 574 | 976 | 2,190 | 3,160 | 12 | 690 | 1,640 | 871 | 1,950 | 2,820 | 615 | 1,460 |
| New Hampshire | 2.9 | .3 | .1 | .9 | 1.0 | 0 | 0 | .9 | .1 | .8 | .9 | 0 | .8 |
| New Jersey | 100 | 3.4 | 25 | 40 | 65 | 0 | 0 | 47 | 22 | 36 | 58 | 0 | 42 |
| New Mexico | 421 | 564 | 1,540 | 1,840 | 3,380 | 0 | 661 | 1,990 | 1,370 | 1,640 | 3,010 | 590 | 1,780 |
| New York | 68 | .5 | 32 | 29 | 61 | 0 | 0 | 55 | 28 | 26 | 54 | 0 | 49 |
| North Carolina | 184 | .2 | 13 | 114 | 127 | 19 | 0 | 127 | 12 | 102 | 114 | 0 | 114 |
| North Dakota | 109 | 59 | 88 | 96 | 184 | 0 | 6.6 | 165 | 78 | 86 | 164 | 5.9 | 148 |
| Ohio | 66 | 0 | 5.2 | 12 | 17 | 0 | .1 | 16 | 4.7 | 11 | 15 | .1 | 14 |
| Oklahoma | 317 | 186 | 553 | 121 | 673 | 0 | 6.0 | 426 | 493 | 108 | 601 | 5.4 | 380 |
| Oregon | 1,070 | 965 | 631 | 7,060 | 7,690 | 12 | 1,430 | 3,350 | 563 | 6,300 | 6,860 | 1,270 | 2,990 |
| Pennsylvania | 30 | 0 | 4.0 | 12 | 16 | 0 | 0 | 16 | 3.5 | 11 | 14 | 0 | 14 |
| Rhode Island | 6.8 | 0 | .3 | 2.0 | 2.4 | 0 | 0 | 2.4 | .3 | 1.8 | 2.1 | 0 | 2.1 |
| South Carolina | 69 | 0 | 34 | 28 | 61 | 16 | 0 | 61 | 30 | 25 | 55 | 0 | 55 |
| South Dakota | 287 | 109 | 158 | 281 | 439 | 0 | 69 | 305 | 141 | 251 | 392 | 62 | 272 |
| Tennessee | 45 | .5 | 17 | 26 | 43 | .8 | 0 | 26 | 15 | 23 | 38 | 0 | 23 |
| Texas | 2,160 | 4,060 | 6,270 | 3,250 | 9,520 | 38 | 740 | 7,990 | 5,590 | 2,900 | 8,490 | 660 | 7,130 |
| Utah | 457 | 837 | 569 | 3,460 | 4,020 | 44 | 699 | 2,160 | 508 | 3,080 | 3,590 | 624 | 1,930 |
| Vermont | 1.8 | .2 | 0 | .5 | .6 | 0 | 0 | .5 | 0 | .5 | .5 | 0 | .5 |
| Virginia | 90 | 0 | 8.9 | 31 | 40 | 0 | 4.0 | 26 | 7.9 | 28 | 36 | 3.6 | 23 |
| Washington | 1,510 | 472 | 845 | 5,920 | 6,760 | 0 | 1,120 | 2,930 | 754 | 5,280 | 6,030 | 997 | 2,610 |
| West Virginia | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wisconsin | 227 | 0 | 168 | 2.0 | 170 | 0 | 0 | 170 | 150 | 1.8 | 151 | 0 | 151 |
| Wyoming | 211 | 1,730 | 266 | 7,760 | 8,020 | 0 | 2,410 | 2,910 | 237 | 6,920 | 7,160 | 2,150 | 2,590 |
| Puerto Rico | 21 | 14 | 60 | 97 | 157 | 0 | 19 | 102 | 54 | 87 | 140 | 17 | 91 |
| Virgin Islands | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 22,800 | 34,600 | 57,200 | 95,900 | 153,000 | 740 | 30,800 | 85,400 | 51,000 | 85,500 | 137,000 | 27,500 | 76,200 |

# Livestock

Livestock water use includes water for livestock, feed lots, dairies, fish farms, and other on-farm needs. The "Livestock category" includes livestock water use, which is defined as water associated with the production of red meat, poultry, eggs, milk, and wool; and animal specialities water use, which is defined as water use associated with the production of fish in captivity (except fish hatcheries), furbearing animals in captivity, horses, rabbits, and pets (Office of Management and Budget, 1987, p. 27-29). A few States, such as Arkansas, Oregon, and California, have some offstream fish hatcheries that are included in the commercial category in this report. Water used instream for fish hatcheries is not included in this report.

Livestock use in this report is equivalent to the livestock category listed under "Livestock" or "Rural use" in previous water-use circulars in this series. In this report, animal specialties are separated from livestock activities because of the large increase in fish-farming water use. Fish farms are primarily engaged in the production of food fish under controlled feeding, sanitation, and harvesting procedures (Office of Management and Budget, 1987, p.29). Most water used for fish farms is required to maintain acceptable pond levels and water quality.

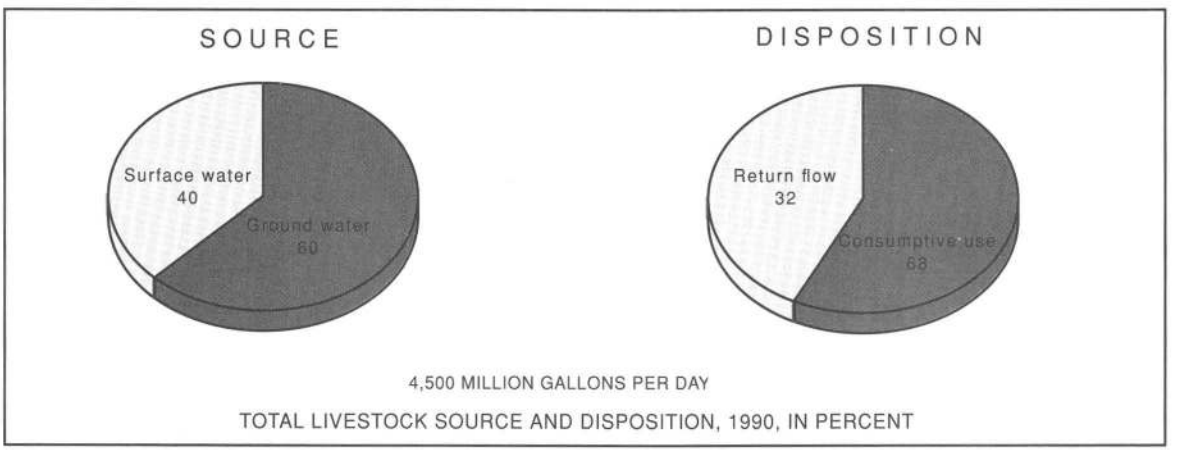
The quantity of surface water and ground water withdrawn for use by livestock was estimated from the numbers of animals in a county. The livestock and poultry numbers are available in most States from the U.S. Department of Agriculture Crop and Livestock Reporting Service or the Cooperative Extension Service. The number of each type of animal in each county was multiplied by an average water use per animal to obtain the water-use estimate. The Crop and Livestock Reporting Service or the Cooperative Extension Service generally have pond acreage for fish farms. Water use is estimated by multiplying pond acreage by an application rate. In some States, water use for fish farms is reported under a permit system.

The uncertainties in the livestock water-use estimates include difficulties in determining the sources of water and great variations in estimates of consumptive use. Consumptive use estimates generally were based on coefficients ranging from 10 to 100 percent of withdrawals.

The quantity of water withdrawn for total livestock purposes (livestock, animal specialties) during 1990 was an estimated 4,500 Mgal/d (tables 17, 18), or less than 1 percent more than withdrawn during 1985. Several States, including Louisiana and North Carolina, reported a significant increase in animal specialties water use, primarily fish farming. Idaho reported a significant decrease based on more reliable information. Total livestock use represents 1 percent of total freshwater use for all offstream categories.

The source and disposition of water for total livestock are shown in the chart below. Ground water was the source for about 60 percent of withdrawals for total livestock use, and surface water was the source for the remaining 40 percent. The consumptive use of water for total livestock during 1990 was about 3,040 Mgal/d, or 68 percent of withdrawals for total livestock use.

The Lower Mississippi and Pacific Northwest water-resources regions had the most water withdrawn for total livestock (figure 18) and accounted for nearly 38 percent of the Nation's total livestock use. The Missouri Basin and Arkansas-White-Red regions had the most water withdrawn for livestock, and the Lower Mississippi and Pacific Northwest regions had the most water withdrawn for animal specialties. By State, Idaho and Louisiana used the most water for total livestock (figure 19); Louisiana, Idaho, and Mississippi accounted for 64 percent of the Nation's animal specialties water use, largely because of fish farming.




TOTAL LIVESTOCK SOURCE AND DISPOSITION, 1990, IN PERCENT

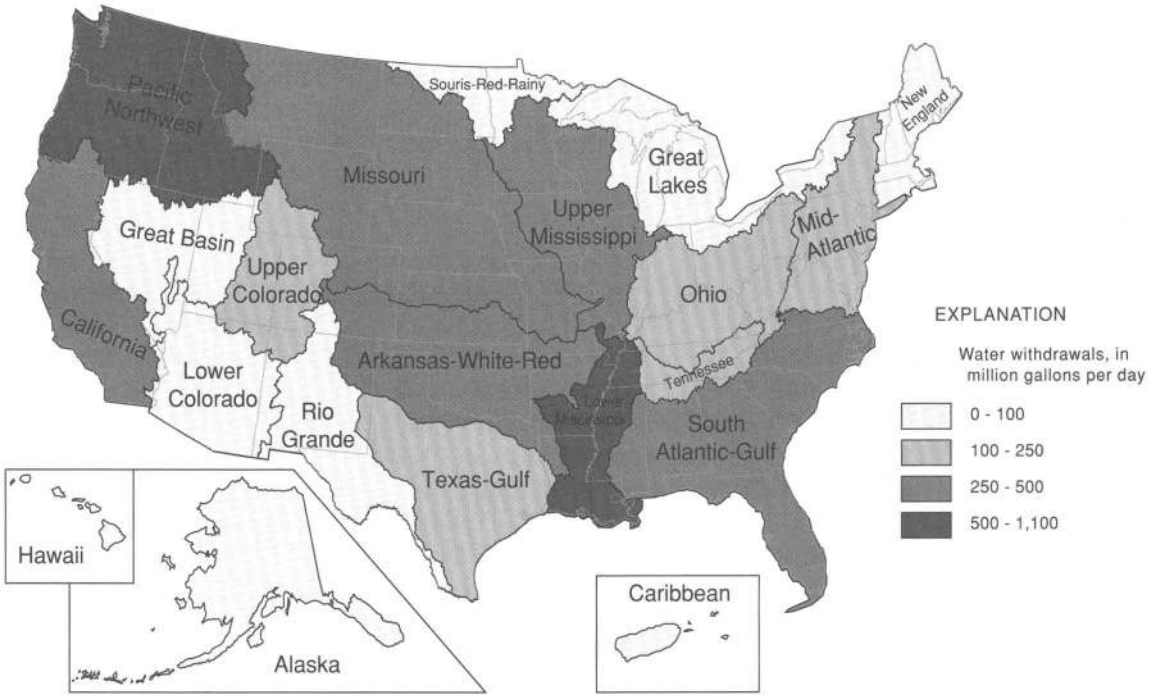



**Figure 18.** Total livestock freshwater withdrawals by water-resources region, 1990.

**Table 17.** Livestock freshwater use by water-resources region, 1990

[Figures may not add to totals because of independent rounding. All values in million gallons per day]

| REGION | LIVESTOCK | | | | ANIMAL SPECIALTIES | | | | TOTAL LIVESTOCK | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Withdrawals | | | | Withdrawals | | | | Withdrawals | | | |
| | Ground water | Surface water | Total | Consumptive use | Ground water | Surface water | Total | Consumptive use | Ground water | Surface water | Total | Consumptive use |
| New England | 4.9 | 2.5 | 7.5 | 6.8 | 0.4 | 0.2 | 0.6 | 0.6 | 5.4 | 2.8 | 8.1 | 7.4 |
| Mid Atlantic | 66 | 25 | 90 | 78 | 5.4 | 4.0 | 9.4 | 1.5 | 71 | 29 | 100 | 79 |
| South Atlantic-Gulf | 123 | 73 | 196 | 196 | 75 | 79 | 154 | 61 | 198 | 152 | 350 | 257 |
| Great Lakes | 49 | 23 | 72 | 62 | 2.1 | 18 | 20 | 2.4 | 51 | 41 | 92 | 64 |
| Ohio | 51 | 74 | 125 | 111 | 2.6 | 4.8 | 7.4 | 4.6 | 54 | 79 | 132 | 116 |
| Tennessee | 18 | 15 | 33 | 33 | 14 | 154 | 168 | 23 | 32 | 169 | 201 | 56 |
| Upper Mississippi | 193 | 43 | 236 | 217 | 23 | 9.0 | 32 | 17 | 217 | 52 | 269 | 233 |
| Lower Mississippi | 13 | 15 | 28 | 28 | 697 | 342 | 1,040 | 890 | 710 | 358 | 1,070 | 918 |
| Souris-Red-Rainy | 16 | 4.9 | 21 | 21 | .1 | 0 | .1 | .1 | 16 | 4.9 | 21 | 21 |
| Missouri Basin | 229 | 155 | 384 | 380 | 13 | 18 | 31 | 5.9 | 242 | 172 | 415 | 386 |
| Arkansas-White-Red | 147 | 191 | 337 | 336 | 12 | 9.7 | 21 | 14 | 158 | 200 | 359 | 350 |
| Texas-Gulf | 54 | 102 | 156 | 155 | 0 | 0 | 0 | 0 | 54 | 102 | 156 | 155 |
| Rio Grande | 20 | 11 | 31 | 25 | 0 | 1.9 | 1.9 | 0 | 20 | 13 | 33 | 25 |
| Upper Colorado | 5.3 | 105 | 110 | 12 | 0 | 7.4 | 7.4 | .1 | 5.3 | 112 | 117 | 12 |
| Lower Colorado | 28 | 11 | 38 | 31 | 2.8 | 57 | 60 | .2 | 30 | 68 | 98 | 31 |
| Great Basin | 27 | 9.1 | 36 | 7.9 | .2 | .7 | .9 | .3 | 27 | 9.9 | 37 | 8.1 |
| Pacific Northwest | 73 | 28 | 101 | 59 | 518 | .9 | 519 | 1.4 | 591 | 29 | 620 | 60 |
| California | 101 | 130 | 232 | 217 | 100 | 74 | 173 | 31 | 201 | 204 | 405 | 249 |
| Alaska | .1 | .5 | .6 | .6 | 0 | 0 | 0 | 0 | .1 | .5 | .6 | .6 |
| Hawaii | 2.1 | 3.4 | 5.4 | 5.4 | 1.4 | .4 | 1.8 | 0 | 3.4 | 3.8 | 7.2 | 5.4 |
| Caribbean | 5.1 | 3.7 | 8.8 | 8.7 | .1 | 0 | .1 | .1 | 5.2 | 3.7 | 8.9 | 8.9 |
| Total | 1,220 | 1,020 | 2,250 | 1,990 | 1,470 | 789 | 2,260 | 1,050 | 2,690 | 1,810 | 4,500 | 3,040 |


**Figure 19.** Total livestock freshwater withdrawals by State, 1990.

**Table 18.** Livestock freshwater use by State, 1990

[Figures may not add to totals because of independent rounding. All values in million gallons per day]

| STATE | LIVESTOCK | | | | ANIMAL SPECIALTIES | | | | TOTAL LIVESTOCK | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Withdrawals | | | Consumptive use | Withdrawals | | | Consumptive use | Withdrawals | | | Consumptive use |
| | Ground water | Surface water | Total | | Ground water | Surface water | Total | | Ground water | Surface water | Total | |
| Alabama | 41 | 23 | 64 | 64 | 31 | 46 | 77 | 16 | 72 | 69 | 141 | 79 |
| Alaska | .1 | .5 | .6 | .6 | 0 | 0 | 0 | 0 | .1 | .5 | .6 | .6 |
| Arizona | 23 | 6.6 | 29 | 22 | 2.8 | 57 | 60 | .2 | 26 | 64 | 89 | 22 |
| Arkansas | 26 | 42 | 68 | 68 | 99 | 22 | 121 | 68 | 125 | 64 | 189 | 136 |
| California | 105 | 132 | 238 | 223 | 100 | 74 | 173 | 31 | 205 | 206 | 411 | 255 |
| Colorado | 22 | 126 | 147 | 43 | 0 | 14 | 14 | 0 | 22 | 140 | 162 | 43 |
| Connecticut | .9 | .3 | 1.2 | 1.0 | .2 | .1 | .3 | .3 | 1.1 | .4 | 1.5 | 1.3 |
| Delaware | 2.1 | .3 | 2.4 | 2.4 | 0 | 0 | 0 | 0 | 2.1 | .3 | 2.4 | 2.4 |
| D.C. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Florida | 50 | 9.0 | 59 | 59 | 18 | .6 | 19 | 19 | 69 | 9.6 | 78 | 78 |
| Georgia | 1.6 | 27 | 28 | 28 | 8.2 | 9.0 | 17 | 17 | 9.9 | 36 | 46 | 46 |
| Hawaii | 2.1 | 3.4 | 5.4 | 5.4 | 1.4 | .4 | 1.8 | 0 | 3.4 | 3.8 | 7.2 | 5.4 |
| Idaho | 48 | 0 | 48 | 9.7 | 512 | 0 | 512 | 0 | 560 | 0 | 560 | 9.7 |
| Illinois | 52 | 0 | 52 | 41 | 9.0 | 2.2 | 11 | 11 | 61 | 2.2 | 63 | 52 |
| Indiana | 25 | 20 | 46 | 36 | .5 | 0 | .5 | .5 | 26 | 20 | 46 | 37 |
| Iowa | 89 | 30 | 118 | 118 | 1.9 | .5 | 2.4 | 2.4 | 91 | 30 | 121 | 121 |
| Kansas | 78 | 30 | 108 | 108 | 4.7 | 1.2 | 5.9 | 5.9 | 83 | 31 | 114 | 114 |
| Kentucky | 1.5 | 30 | 32 | 32 | 0 | .9 | .9 | .9 | 1.6 | 31 | 33 | 33 |
| Louisiana | 3.5 | 5.0 | 8.5 | 8.4 | 219 | 324 | 543 | 542 | 222 | 329 | 551 | 550 |
| Maine | .6 | 1.1 | 1.7 | 1.5 | 0 | 0 | 0 | 0 | .6 | 1.1 | 1.7 | 1.5 |
| Maryland | 7.9 | 2.4 | 10 | 10 | 4.5 | 5 | 12 | 0 | 12 | 7 | 20 | 10 |
| Massachusetts | 1.2 | .4 | 1.6 | 1.6 | .1 | 0 | .2 | .2 | 1.4 | .4 | 1.7 | 1.7 |
| Michigan | 18 | 4.8 | 23 | 19 | .7 | 5.5 | 6.3 | .8 | 19 | 10 | 29 | 20 |
| Minnesota | 55 | 9.7 | 65 | 65 | 1.6 | .6 | 2.2 | 2.2 | 57 | 10 | 67 | 67 |
| Mississippi | 6.3 | 9.4 | 16 | 16 | 393 | 2.4 | 395 | 292 | 399 | 12 | 411 | 308 |
| Missouri | 13 | 39 | 52 | 52 | .8 | 1.7 | 2.5 | 2.5 | 14 | 41 | 55 | 55 |
| Montana | 16 | 35 | 51 | 51 | .3 | .6 | .9 | .9 | 16 | 36 | 52 | 52 |
| Nebraska | 102 | 19 | 121 | 121 | 5.9 | 12 | 18 | 1.8 | 108 | 31 | 139 | 122 |
| Nevada | 1.0 | 4.1 | 5.1 | 2.1 | 0 | .5 | .5 | 0 | 1.0 | 4.6 | 5.6 | 2.1 |
| New Hampshire | .7 | .2 | 1.0 | .8 | 0 | 0 | 0 | 0 | .8 | .3 | 1.0 | .9 |
| New Jersey | 1.5 | 0 | 1.5 | 1.5 | .6 | 0 | .6 | .6 | 2.1 | 0 | 2.1 | 2.1 |
| New Mexico | 18 | 3.6 | 22 | 21 | 0 | 0 | 0 | 0 | 18 | 3.6 | 22 | 21 |
| New York | 15 | 10 | 25 | 23 | .4 | .1 | .5 | .5 | 15 | 10 | 26 | 23 |
| North Carolina | 34 | 5.7 | 39 | 39 | 2.1 | 159 | 162 | 2.1 | 36 | 165 | 201 | 41 |
| North Dakota | 13 | 8.8 | 22 | 22 | 0 | 2.2 | 2.2 | 0 | 13 | 11 | 24 | 22 |
| Ohio | 7.3 | 26 | 33 | 32 | .5 | 0 | .5 | 0 | 7.8 | 26 | 34 | 32 |
| Oklahoma | 35 | 95 | 131 | 131 | 0 | .2 | .2 | 0 | 35 | 96 | 131 | 131 |
| Oregon | 3.2 | 18 | 21 | 21 | 0 | .6 | .6 | .6 | 3.2 | 18 | 21 | 21 |
| Pennsylvania | 46 | 6.9 | 53 | 40 | 0 | 0 | 0 | 0 | 46 | 6.9 | 53 | 40 |
| Rhode Island | .1 | .1 | .2 | .1 | 0 | .1 | .2 | .1 | .1 | .2 | .3 | .3 |
| South Carolina | 4.0 | 4.9 | 8.9 | 8.9 | 8.3 | 7.4 | 16 | .8 | 12 | 12 | 25 | 9.7 |
| South Dakota | 17 | 26 | 43 | 43 | 0 | 0 | 0 | 0 | 17 | 26 | 43 | 43 |
| Tennessee | 12 | 9.6 | 21 | 21 | 17 | 11 | 28 | 28 | 29 | 21 | 49 | 49 |
| Texas | 93 | 135 | 228 | 227 | 0 | 0 | 0 | 0 | 93 | 135 | 228 | 227 |
| Utah | 27 | 6.6 | 34 | 6.3 | .2 | .3 | .5 | .3 | 27 | 7.0 | 34 | 6.6 |
| Vermont | 4.5 | 1.5 | 6.0 | 5.4 | 0 | 0 | 0 | 0 | 4.6 | 1.5 | 6.1 | 5.5 |
| Virginia | 8.5 | 20 | 28 | 28 | .1 | .8 | .9 | .9 | 8.5 | 21 | 29 | 29 |
| Washington | 21 | 8.2 | 29 | 25 | .6 | .2 | .8 | .7 | 22 | 8.4 | 30 | 26 |
| West Virginia | 1.3 | 3.4 | 4.7 | 4.0 | 0 | .1 | .1 | .1 | 1.3 | 3.6 | 4.8 | 4.2 |
| Wisconsin | 61 | 6.8 | 68 | 55 | 13 | 18 | 31 | 3.1 | 74 | 25 | 99 | 58 |
| Wyoming | 3.3 | 13 | 16 | 16 | 10 | 0 | 10 | 0 | 14 | 13 | 27 | 16 |
| Puerto Rico | 4.8 | 3.4 | 8.2 | 8.2 | .1 | 0 | .1 | .1 | 4.8 | 3.5 | 8.3 | 8.3 |
| Virgin Islands | .3 | .2 | .5 | .5 | 0 | 0 | 0 | 0 | .3 | .2 | .5 | .5 |
| Total | 1,220 | 1,020 | 2,250 | 1,990 | 1,470 | 789 | 2,260 | 1,050 | 2,690 | 1,810 | 4,500 | 3,040 |

# Industrial

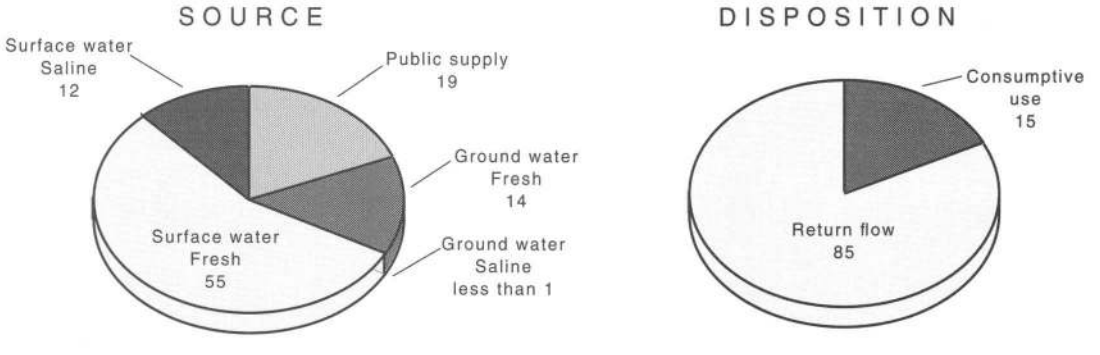
Industrial water use includes water for such purposes as processing, washing, and cooling in facilities that manufacture products. Major water-using industries include, but are not limited to, steel, chemical and allied products, paper and allied products, and petroleum refining.

Many States have developed permit programs that require reporting of industrial withdrawals and return flows. Estimates for 1990 are improved over those of previous years because of the availability of more comprehensive inventories of industrial facilities and more complete water-use records. Information on deliveries from public suppliers to industrial users were estimated from a variety of methods if not available directly from public suppliers. Consumptive-use estimates generally were based on coefficients ranging from 3 to 80 percent (depending on the type of industry) of withdrawals and deliveries.

Industrial water use (freshwater withdrawals, public-supply deliveries, saline water withdrawals) during 1990 was an estimated 19,300 Mgal/d of self-supplied freshwater, 5,190 Mgal/d of public-supplied freshwater, and an additional 3,270 Mgal/d of saline water. (See tables 19, 20.) Industrial freshwater use during 1990 was 13 percent less than during 1985 and represents 7 percent of total freshwater use for all offstream categories. Surface water was the source for about 82 percent of self-supplied industrial withdrawals; ground water, 18 percent; and reclaimed wastewater, only a fraction of 1 percent. Public-supplied deliveries to industries accounted for 13 percent of public-supply withdrawals.

The source and disposition of water for industrial purposes are shown in the chart below. The consumptive use of freshwater for industrial purposes during 1990 was 3,330 Mgal/d, or 14 percent of freshwater withdrawals and deliveries; saline consumptive use was 913 Mgal/d, or about 28 percent of saline water withdrawals.

In 1990, the Great Lakes and Mid Atlantic water-resources regions had the largest withdrawals for industrial purposes as shown in figure 20. Indiana, Louisiana, Texas, Pennsylvania, and Michigan reported the largest withdrawals for industries as shown in figure 21. Indiana, Louisiana, Pennsylvania, and Michigan reported the largest freshwater use (figure 22), and Maryland and Texas reported the largest quantities of reclaimed wastewater used by industries.




INDUSTRIAL SOURCE AND DISPOSITION, 1990, IN PERCENT

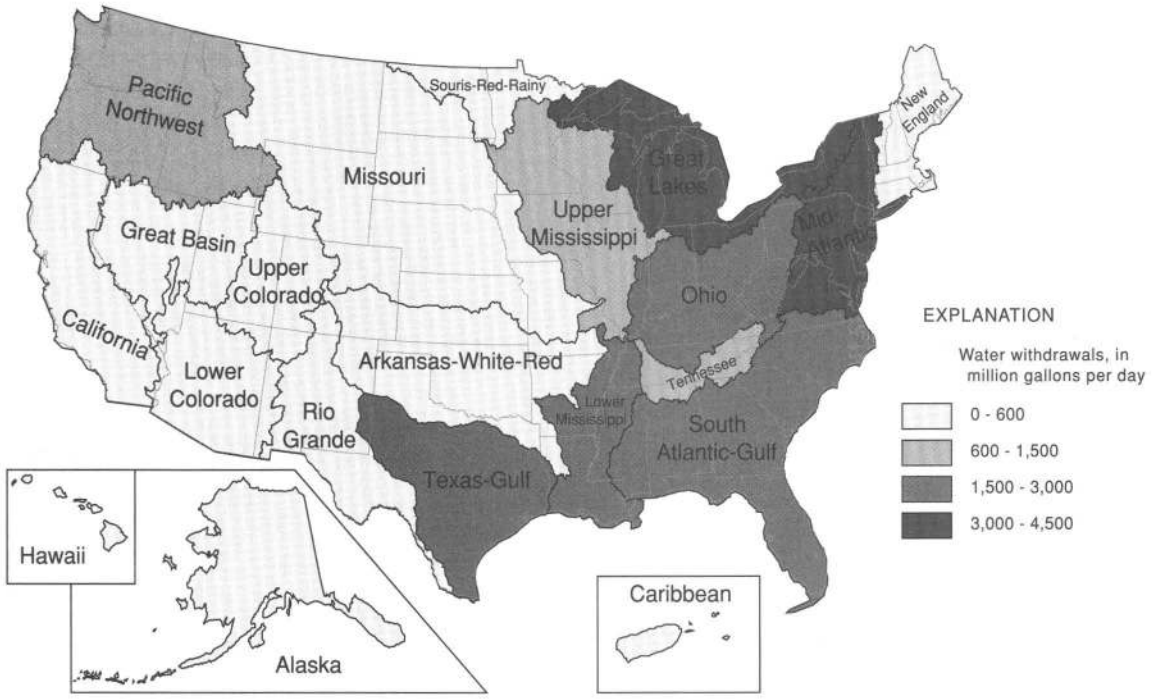



**Figure 20.** Industrial water withdrawals (fresh, saline) by water-resources region, 1990.

**Table 19.** Industrial water use by water-resources region, 1990

[Figures may not add to totals because of independent rounding. All values in million gallons per day]

| REGION | SELF-SUPPLIED WITHDRAWALS | | | | | | | RECLAIMED WASTE-WATER | PUBLIC-SUPPLY DELIV-ERIES | TOTAL USE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | By source and type | | | | Total | | | | | With-drawals and deliveries | Consumptive use | |
| | Ground water | | Surface water | | | | | | | | | |
| | Fresh | Saline | Fresh | Saline | Fresh | Saline | Total | | Fresh | Fresh | Fresh | Saline |
| New England | 96 | 0.0 | 382 | 68 | 479 | 68 | 547 | 0.0 | 219 | 698 | 71 | 14 |
| Mid Atlantic | 360 | .2 | 1,370 | 1,470 | 1,730 | 1,470 | 3,200 | 63 | 672 | 2,400 | 256 | 85 |
| South Atlantic-Gulf | 896 | 0 | 1,920 | 94 | 2,810 | 94 | 2,910 | .5 | 855 | 3,670 | 470 | 2.9 |
| Great Lakes | 235 | 3.7 | 3,950 | 0 | 4,190 | 3.7 | 4,190 | 0 | 852 | 5,040 | 458 | .4 |
| Ohio | 532 | 0 | 1,840 | 0 | 2,370 | 0 | 2,370 | 0 | 615 | 2,990 | 297 | 0 |
| Tennessee | 23 | 0 | 1,170 | 0 | 1,190 | 0 | 1,190 | 0 | 94 | 1,290 | 163 | 0 |
| Upper Mississippi | 349 | 0 | 618 | 0 | 967 | 0 | 967 | 0 | 467 | 1,430 | 214 | 0 |
| Lower Mississippi | 501 | .6 | 2,120 | 67 | 2,620 | 67 | 2,690 | 0 | 70 | 2,690 | 286 | .4 |
| Souris-Red-Rainy | 1.3 | 0 | 47 | 0 | 49 | 0 | 49 | 0 | 3.4 | 52 | 9.5 | 0 |
| Missouri Basin | 114 | 0 | 57 | 0 | 171 | 0 | 171 | 0 | 112 | 282 | 87 | 0 |
| Arkansas-White-Red | 67 | 0 | 301 | 0 | 368 | 0 | 368 | 1.9 | 257 | 625 | 113 | 0 |
| Texas-Gulf | 141 | 1.1 | 600 | 1,460 | 741 | 1,460 | 2,200 | 20 | 143 | 884 | 359 | 803 |
| Rio Grande | 11 | 0 | 1.0 | 0 | 12 | 0 | 12 | .5 | 19 | 31 | 16 | 0 |
| Upper Colorado | 2.9 | 0 | 2.5 | 0 | 5.4 | 0 | 5.4 | 0 | 4.4 | 9.7 | 4.7 | 0 |
| Lower Colorado | 49 | 0 | 124 | 0 | 174 | 0 | 174 | 2.3 | 80 | 254 | 227 | 0 |
| Great Basin | 77 | 2.3 | 29 | 0 | 106 | 2.3 | 108 | 0 | 21 | 127 | 55 | 1.0 |
| Pacific Northwest | 336 | 0 | 691 | 36 | 1,030 | 36 | 1,060 | 1.6 | 175 | 1,200 | 125 | 4.8 |
| California | 126 | 0 | 4.8 | 25 | 130 | 25 | 156 | .8 | 495 | 625 | 102 | .3 |
| Alaska | 5.2 | 0 | 106 | 0 | 111 | 0 | 111 | 0 | 18 | 129 | 13 | 0 |
| Hawaii | 20 | .6 | 23 | 0 | 43 | .6 | 44 | 0 | 7.5 | 51 | 2.2 | 0 |
| Caribbean | 11 | 1.2 | 0 | 50 | 11 | 51 | 62 | 0 | 12 | 23 | 6.5 | 1.0 |
| Total | 3,950 | 9.7 | 15,400 | 3,260 | 19,300 | 3,270 | 22,600 | 90 | 5,190 | 24,500 | 3,330 | 913 |

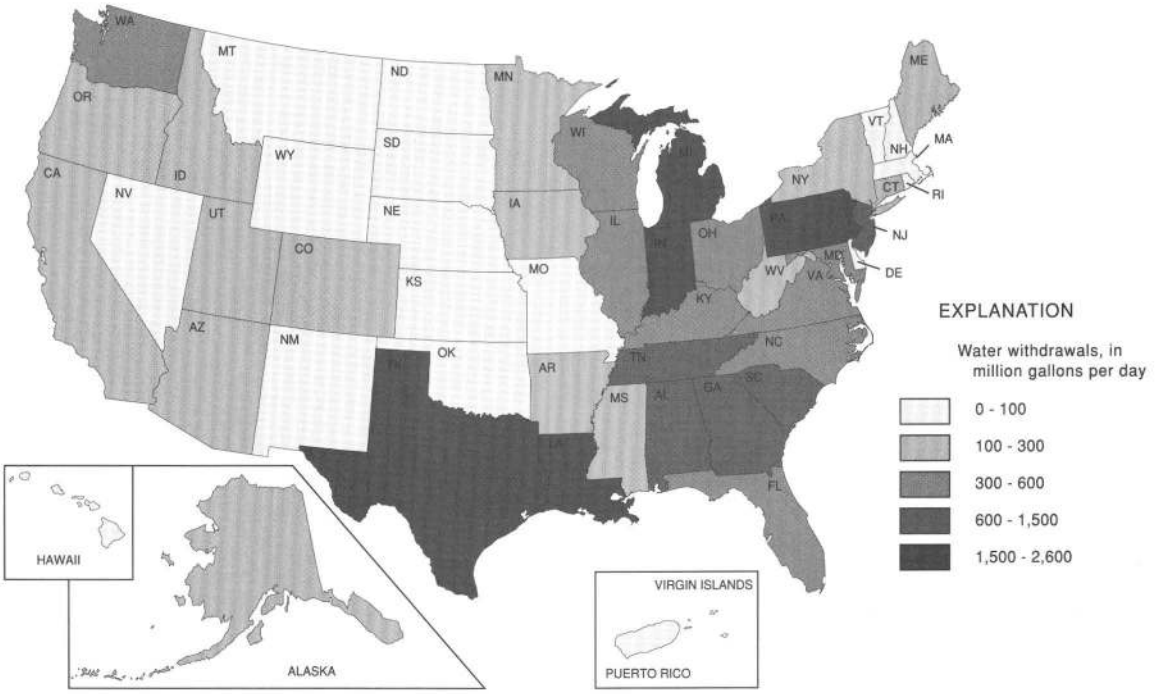



**Figure 21.** Industrial water withdrawals (fresh, saline) by State, 1990.

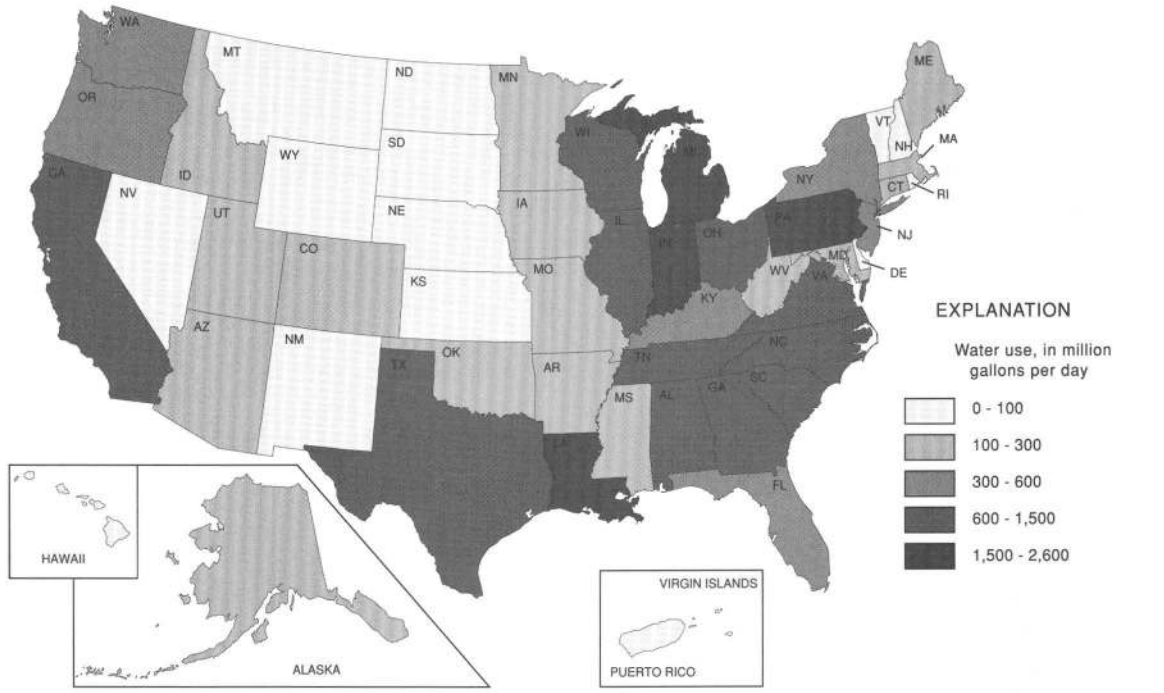



**Figure 22.** Industrial freshwater use (withdrawals, deliveries) by State, 1990.

**Table 20.** Industrial water use by State, 1990

[Figures may not add to totals because of independent rounding. All values in million gallons per day]

| STATE | SELF-SUPPLIED WITHDRAWALS | | | | | | | | PUBLIC-SUPPLY DELIVERIES | TOTAL USE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | By source and type | | | | Total | | | RECLAIMED WASTEWATER | | Withdrawals and deliveries | Consumptive use | |
| | Ground water | | Surface water | | | | | | | | | |
| | Fresh | Saline | Fresh | Saline | Fresh | Saline | Total | | Fresh | Fresh | Fresh | Saline |
| Alabama | 31 | 0.0 | 753 | 0.0 | 784 | 0.0 | 784 | 0.0 | 185 | 969 | 194 | 0.0 |
| Alaska | 5.2 | 0 | 106 | 0 | 111 | 0 | 111 | 0 | 18 | 129 | 13 | 0 |
| Arizona | 39 | 0 | 124 | 0 | 163 | 0 | 163 | 2.3 | 78 | 242 | 223 | 0 |
| Arkansas | 99 | 0 | 78 | 0 | 177 | 0 | 177 | 0 | .7 | 178 | 13 | 0 |
| California | 125 | 0 | 3.4 | 25 | 129 | 25 | 154 | .8 | 492 | 621 | 101 | .3 |
| Colorado | 33 | 0 | 85 | 0 | 118 | 0 | 118 | 0 | 21 | 139 | 41 | 0 |
| Connecticut | 19 | 0 | 61 | 68 | 80 | 68 | 148 | 0 | 64 | 144 | 16 | 14 |
| Delaware | 18 | 0 | 47 | 6.0 | 65 | 6.0 | 71 | 0 | 15 | 80 | 12 | 0 |
| D.C. | .5 | 0 | 0 | 0 | .5 | 0 | .5 | 0 | 0 | .5 | 0 | 0 |
| Florida | 282 | 0 | 121 | 56 | 403 | 56 | 459 | 0 | 183 | 586 | 67 | 0 |
| Georgia | 346 | 0 | 311 | 33 | 657 | 33 | 689 | .5 | 157 | 814 | 77 | 2.3 |
| Hawaii | 20 | .6 | 23 | 0 | 43 | .6 | 44 | 0 | 7.5 | 51 | 2.2 | 0 |
| Idaho | 170 | 0 | 26 | 0 | 196 | 0 | 196 | 0 | 3.8 | 200 | 6.0 | 0 |
| Illinois | 155 | 0 | 309 | 0 | 464 | 0 | 464 | 0 | 263 | 728 | 80 | 0 |
| Indiana | 129 | 0 | 2,350 | 0 | 2,480 | 0 | 2,480 | 0 | 105 | 2,590 | 155 | 0 |
| Iowa | 71 | 0 | 148 | 0 | 219 | 0 | 219 | 0 | 34 | 253 | 33 | 0 |
| Kansas | 50 | 0 | 3.8 | 0 | 53 | 0 | 53 | .5 | 35 | 88 | 30 | 0 |
| Kentucky | 93 | 0 | 220 | 0 | 313 | 0 | 313 | 0 | 199 | 512 | 19 | 0 |
| Louisiana | 289 | .6 | 2,070 | 67 | 2,360 | 67 | 2,430 | 0 | 32 | 2,390 | 265 | .4 |
| Maine | 9.8 | 0 | 244 | 0 | 254 | 0 | 254 | 0 | 17 | 270 | 27 | 0 |
| Maryland | 20 | 0 | 50 | 379 | 70 | 379 | 449 | 63 | 52 | 122 | 18 | 57 |
| Massachusetts | 65 | 0 | 22 | 0 | 87 | 0 | 87 | 0 | 108 | 195 | 20 | 0 |
| Michigan | 175 | 3.7 | 1,510 | 0 | 1,680 | 3.7 | 1,690 | 0 | 411 | 2,100 | 152 | .4 |
| Minnesota | 65 | 0 | 89 | 0 | 154 | 0 | 154 | 0 | 44 | 198 | 35 | 0 |
| Mississippi | 144 | 0 | 126 | 0 | 269 | 0 | 269 | 0 | 19 | 288 | 46 | 0 |
| Missouri | 53 | 0 | 32 | 0 | 85 | 0 | 85 | 0 | 133 | 218 | 29 | 0 |
| Montana | 30 | 0 | 27 | 0 | 57 | 0 | 57 | 0 | 1.0 | 58 | 8.8 | 0 |
| Nebraska | 39 | 0 | 2.4 | 0 | 41 | 0 | 41 | 0 | 33 | 74 | 31 | 0 |
| Nevada | 9.4 | 0 | .8 | 0 | 10 | 0 | 10 | 0 | 2.6 | 13 | 2.5 | 0 |
| New Hampshire | .3 | 0 | 37 | 0 | 37 | 0 | 37 | 0 | 15 | 53 | 5.3 | 0 |
| New Jersey | 53 | .2 | 273 | 1,020 | 326 | 1,020 | 1,340 | 0 | 241 | 567 | 45 | 20 |
| New Mexico | 4.6 | 0 | 1.7 | 0 | 6.3 | 0 | 6.3 | 0 | 15 | 21 | 14 | 0 |
| New York | 85 | 0 | 189 | 0 | 274 | 0 | 274 | 0 | 314 | 588 | 60 | 0 |
| North Carolina | 63 | 0 | 328 | 5.5 | 390 | 5.5 | 396 | 0 | 245 | 635 | 34 | .6 |
| North Dakota | 2.1 | 0 | 6.6 | 0 | 8.8 | 0 | 8.8 | 0 | 2.6 | 11 | 9.2 | 0 |
| Ohio | 123 | 0 | 230 | 0 | 354 | 0 | 354 | 0 | 325 | 679 | 204 | 0 |
| Oklahoma | 3.3 | 0 | 32 | 0 | 35 | 0 | 35 | 0 | 113 | 148 | 10 | 0 |
| Oregon | 31 | 0 | 254 | 0 | 284 | 0 | 284 | 1.6 | 81 | 365 | 39 | 0 |
| Pennsylvania | 180 | 0 | 1,690 | 0 | 1,870 | 0 | 1,870 | 0 | 248 | 2,120 | 189 | 0 |
| Rhode Island | 2.5 | 0 | 9.1 | 0 | 12 | 0 | 12 | 0 | 12 | 24 | 1.7 | 0 |
| South Carolina | 47 | 0 | 585 | 0 | 632 | 0 | 632 | 0 | 46 | 678 | 102 | 0 |
| South Dakota | 5.0 | 0 | 10 | 0 | 15 | 0 | 15 | 0 | 8.0 | 23 | 3.4 | 0 |
| Tennessee | 69 | 0 | 813 | 0 | 882 | 0 | 882 | 0 | 106 | 988 | 109 | 0 |
| Texas | 143 | 1.1 | 741 | 1,460 | 884 | 1,460 | 2,340 | 22 | 255 | 1,140 | 418 | 803 |
| Utah | 77 | 2.3 | 29 | 0 | 106 | 2.3 | 108 | 0 | 21 | 128 | 56 | 1.0 |
| Vermont | 1.0 | 0 | 43 | 0 | 44 | 0 | 44 | 0 | 3.1 | 47 | 4.7 | 0 |
| Virginia | 195 | 0 | 300 | 66 | 495 | 66 | 561 | 0 | 152 | 647 | 78 | 7.9 |
| Washington | 104 | 0 | 397 | 36 | 501 | 36 | 536 | 0 | 93 | 594 | 73 | 4.8 |
| West Virginia | 106 | 0 | 26 | 0 | 132 | 0 | 132 | 0 | 13 | 145 | 22 | 0 |
| Wisconsin | 58 | 0 | 409 | 0 | 468 | 0 | 468 | 0 | 151 | 619 | 125 | 0 |
| Wyoming | 6.0 | 0 | 9.9 | 0 | 16 | 0 | 16 | 0 | 5.5 | 21 | 3.2 | 0 |
| Puerto Rico | 11 | 0 | 0 | 0 | 11 | 0 | 11 | 0 | 12 | 23 | 6.5 | 0 |
| Virgin Islands | .1 | 1.2 | 0 | 50 | .1 | 51 | 51 | 0 | 0 | .1 | 0 | 1.0 |
| Total | 3,950 | 9.7 | 15,400 | 3,260 | 19,300 | 3,270 | 22,600 | 90 | 5,190 | 24,500 | 3,330 | 913 |

# Mining

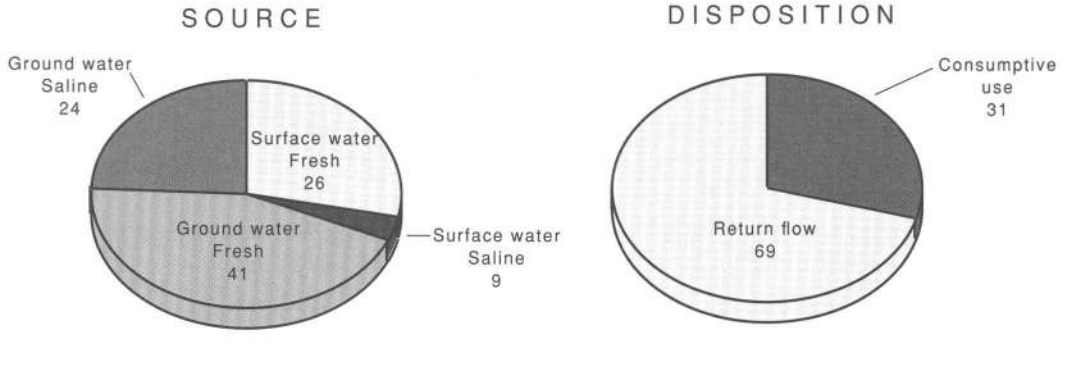
Mining water use includes water for the extraction of naturally occurring materials (including petroleum), dewatering, milling, and other preparations that are a part of mining activities. All water is self supplied and saline water is significant.

Water used in mining is difficult to quantify. Except for some washing and milling, water used at mining sites tends to be an impediment to or a byproduct of the extraction process. Unless water is needed for the mining operation, little attention is paid to quantities withdrawn. Estimates for mining withdrawals were obtained from State agencies that regulate discharges, or by estimating a coefficient for the relation between the quantity of water withdrawn and the quantity of material extracted. Consumptive-use estimates were based on coefficients, ranging from 10 to 100 percent of withdrawals, depending on the type of mining activity.

The quantity of water withdrawn for mining during 1990 was an estimated 3,310 Mgal/d of freshwater, and an additional 1,650 Mgal/d of saline water. (See tables 21, 22.) Mining freshwater use during 1990 was 24 percent more than during 1985, and represents 1 percent of total freshwater use for all offstream categories. Some of the increase can be attributed to a more complete inventory of mines in some States.

The source and disposition of water for mining purposes are shown in the chart below. Ground water was the source for about 65 percent of mining withdrawals, and surface water was the source for the remaining 35 percent. Saline water accounted for approximately one-third of total mining withdrawals. The consumptive use of freshwater and saline water for mining during 1990 was about 1,550 Mgal/d or 31 percent of total withdrawals.

The most water withdrawn for mining use during 1990 was in the Ohio water-resources region, followed by the Texas-Gulf, the South Atlantic-Gulf, and the Mid Atlantic regions, as shown in figure 23. By State, Texas and West Virginia had the most freshwater and saline water withdrawn for mining (figure 24), and accounted for about 23 percent of the Nation's total mining withdrawals. West Virginia and Florida had the most freshwater withdrawn for mining (figure 25).




MINING SOURCE AND DISPOSITION, 1990, IN PERCENT

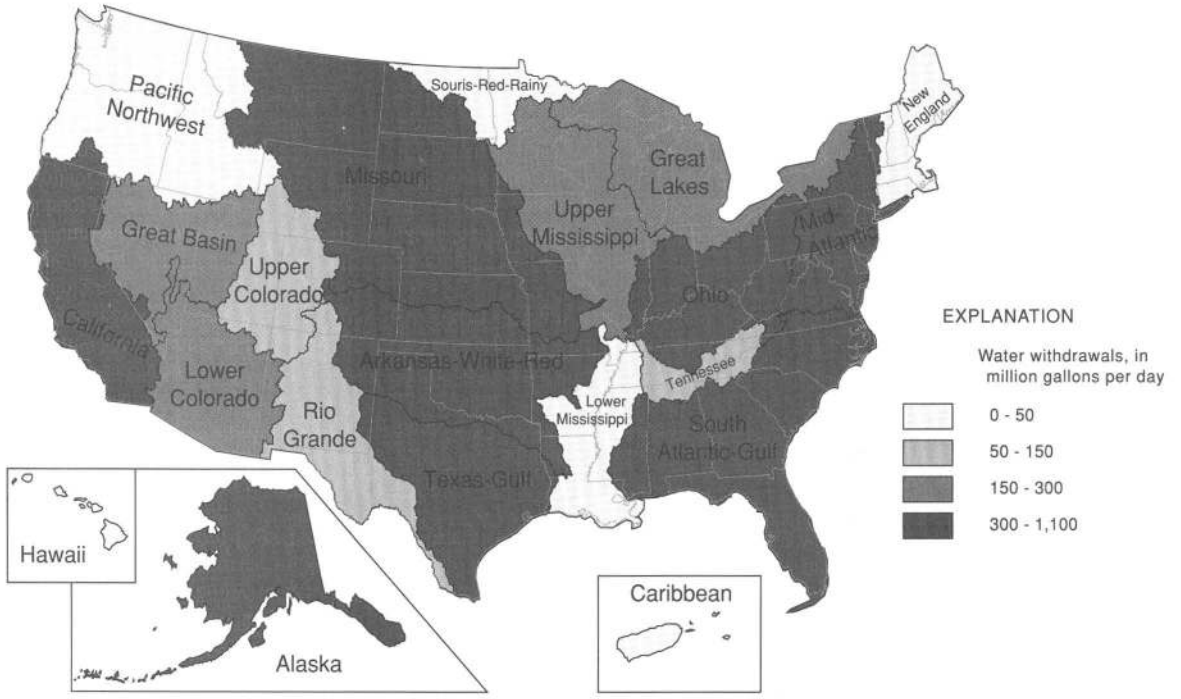



**Figure 23**. Mining water withdrawals (fresh, saline) by water-resources region, 1990.

**Table 21**. Mining water use by water-resources region, 1990

[Figures may not add to totals because of independent rounding. All values in million gallons per day]

| REGION | WITHDRAWALS | | | | | | | | | CONSUMPTIVE USE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | By source and type | | | | | | Total | | | | | |
| | Ground water | | | Surface water | | | | | | | | |
| | Fresh | Saline | Total | Fresh | Saline | Total | Fresh | Saline | Total | Fresh | Saline | Total |
| New England | 1.3 | 0.0 | 1.3 | 19 | 0.0 | 19 | 20 | 0.0 | 20 | 2.2 | 0.0 | 2.2 |
| Mid Atlantic | 210 | 1.0 | 211 | 176 | 29 | 205 | 387 | 30 | 416 | 58 | 23 | 81 |
| South Atlantic-Gulf | 384 | 9.1 | 393 | 53 | 0 | 53 | 437 | 9.1 | 446 | 23 | 3.3 | 26 |
| Great Lakes | 22 | 1.2 | 23 | 227 | 6.5 | 233 | 249 | 7.7 | 257 | 64 | 2.0 | 66 |
| Ohio | 784 | 22 | 806 | 218 | .6 | 219 | 1,000 | 22 | 1,020 | 509 | 22 | 530 |
| Tennessee | 25 | 0 | 25 | 67 | 0 | 67 | 92 | 0 | 92 | 9.6 | 0 | 9.6 |
| Upper Mississippi | 11 | 4.2 | 15 | 143 | 0 | 143 | 154 | 4.2 | 158 | 28 | 4.2 | 33 |
| Lower Mississippi | 7.9 | 0 | 7.9 | 32 | 0 | 32 | 40 | 0 | 40 | 6.1 | 0 | 6.1 |
| Souris-Red-Rainy | .2 | 0 | .2 | 8.0 | 0 | 8.0 | 8.2 | 0 | 8.2 | .4 | 0 | .4 |
| Missouri Basin | 96 | 37 | 134 | 182 | 0 | 182 | 279 | 37 | 316 | 44 | 2.7 | 47 |
| Arkansas-White-Red | 49 | 291 | 340 | 25 | 0 | 25 | 74 | 291 | 365 | 30 | 0 | 30 |
| Texas-Gulf | 84 | 399 | 482 | 47 | 0 | 47 | 130 | 399 | 529 | 121 | 0 | 121 |
| Rio Grande | 65 | 39 | 104 | 1.5 | 0 | 1.5 | 66 | 39 | 105 | 42 | 0 | 42 |
| Upper Colorado | 39 | 28 | 67 | 12 | 0 | 12 | 51 | 28 | 79 | 22 | 1.4 | 24 |
| Lower Colorado | 139 | .6 | 140 | 30 | .2 | 30 | 170 | .7 | 170 | 130 | .7 | 131 |
| Great Basin | 77 | 17 | 94 | 5.7 | 93 | 98 | 83 | 110 | 192 | 57 | 105 | 162 |
| Pacific Northwest | 5.0 | 0 | 5.0 | 10 | 0 | 10 | 15 | 0 | 15 | 2.5 | 0 | 2.5 |
| California | 15 | 310 | 324 | 7.0 | .4 | 7.4 | 22 | 310 | 332 | 6.5 | 225 | 231 |
| Alaska | 4.3 | 48 | 52 | 20 | 308 | 329 | 25 | 357 | 381 | .2 | 3.6 | 3.8 |
| Hawaii | 1.4 | 0 | 1.4 | 0 | 0 | 0 | 1.4 | 0 | 1.4 | 1.2 | 0 | 1.2 |
| Caribbean | 1.9 | 0 | 1.9 | .7 | 0 | .7 | 2.6 | 0 | 2.6 | .8 | 0 | .8 |
| Total | 2,020 | 1,210 | 3,240 | 1,280 | 438 | 1,720 | 3,310 | 1,650 | 4,960 | 1,160 | 393 | 1,550 |

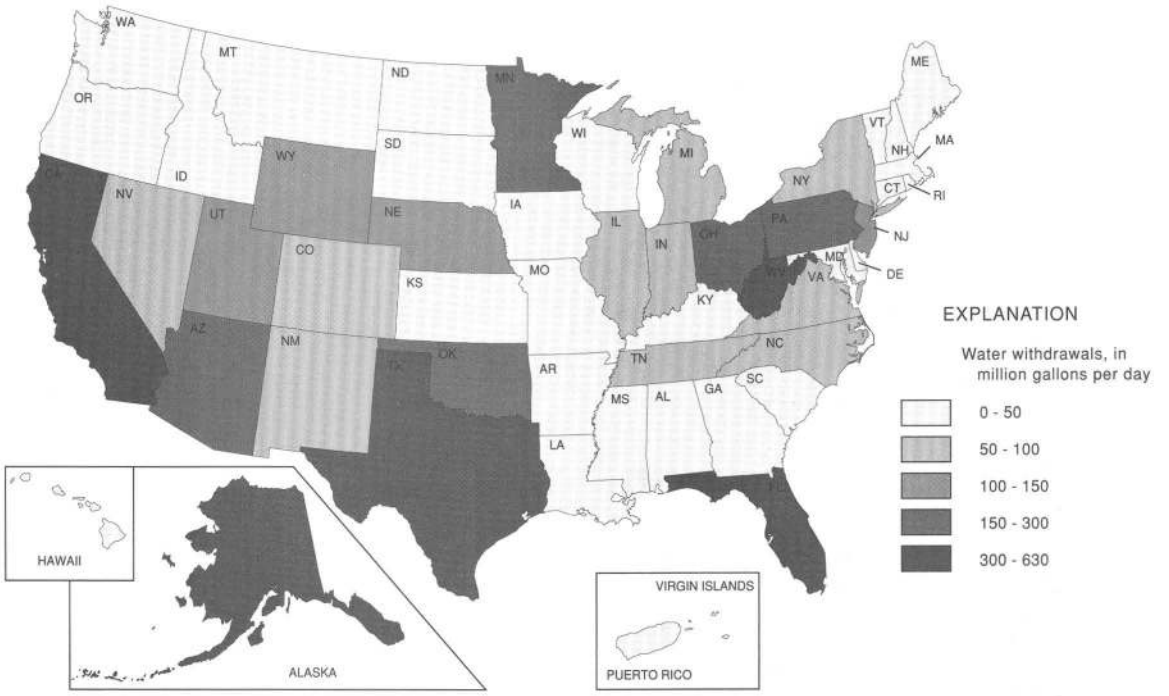



**Figure 24**. Mining withdrawals (fresh, saline) by State, 1990.

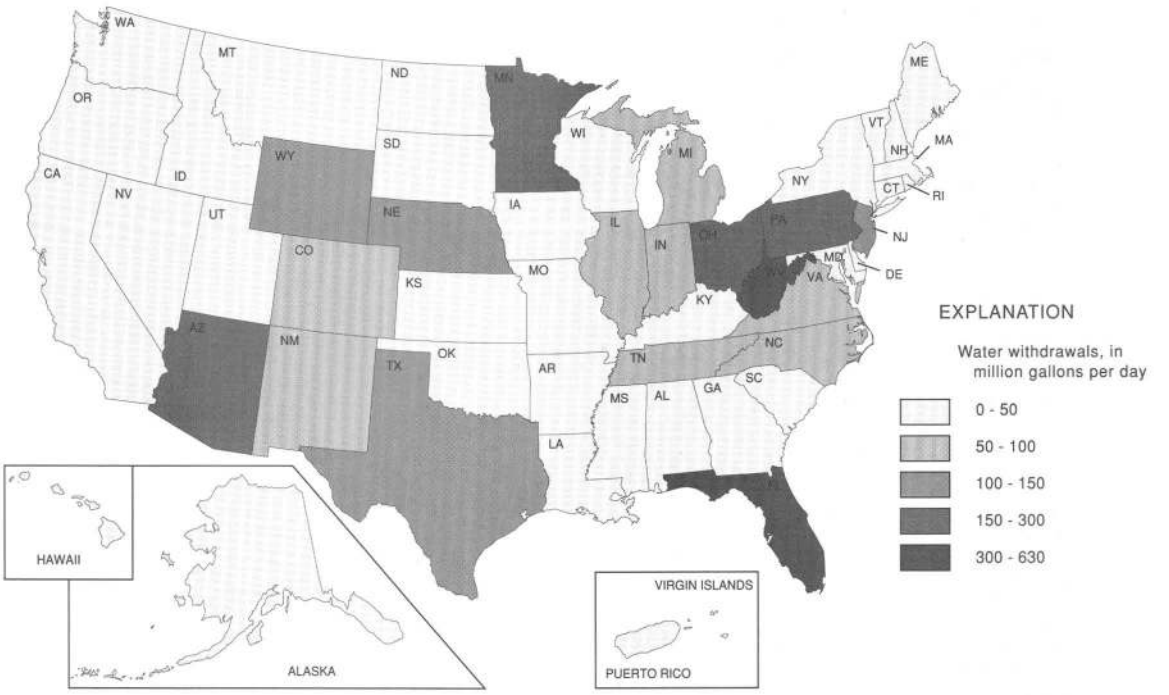



**Figure 25**. Mining freshwater withdrawals by State, 1990.

**Table 22.** Mining water use by State, 1990

[Figures may not add to totals because of independent rounding. All values in million gallons per day]

| STATE | WITHDRAWALS | | | | | | | | | CONSUMPTIVE USE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | By source and type | | | | | | Total | | | | | |
| | Ground water | | | Surface water | | | | | | | | |
| | Fresh | Saline | Total | Fresh | Saline | Total | Fresh | Saline | Total | Fresh | Saline | Total |
| Alabama | 4.0 | 9.1 | 13 | 7.0 | 0.0 | 7.0 | 11 | 9.1 | 20 | 0.0 | 3.3 | 3.3 |
| Alaska | 4.3 | 48 | 52 | 20 | 308 | 329 | 25 | 357 | 381 | .2 | 3.6 | 3.8 |
| Arizona | 127 | .5 | 128 | 29 | .2 | 29 | 156 | .7 | 157 | 119 | .7 | 119 |
| Arkansas | 1.8 | 0 | 1.8 | .7 | 0 | .7 | 2.5 | 0 | 2.5 | 2.5 | 0 | 2.5 |
| California | 13 | 310 | 323 | 7.0 | .4 | 7.4 | 20 | 310 | 330 | 4.4 | 225 | 229 |
| Colorado | 28 | 30 | 57 | 26 | 0 | 26 | 54 | 30 | 84 | 14 | 4.1 | 18 |
| Connecticut | .4 | 0 | .4 | 1.8 | 0 | 1.8 | 2.2 | 0 | 2.2 | .4 | 0 | .4 |
| DElaware | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| D.C. | .5 | 0 | .5 | 0 | 0 | 0 | .5 | 0 | .5 | 0 | 0 | 0 |
| Florida | 299 | 0 | 299 | 17 | 0 | 17 | 315 | 0 | 315 | 15 | 0 | 15 |
| Georgia | 8.7 | 0 | 8.7 | 2.9 | 0 | 2.9 | 12 | 0 | 12 | 0 | 0 | 0 |
| Hawaii | 1.4 | 0 | 1.4 | 0 | 0 | 0 | 1.4 | 0 | 1.4 | 1.2 | 0 | 1.2 |
| Idaho | .6 | 0 | .6 | 7.8 | 0 | 7.8 | 8.4 | 0 | 8.4 | .8 | 0 | .8 |
| Illinois | 7.6 | 25 | 33 | 61 | 0 | 61 | 69 | 25 | 94 | 20 | 25 | 46 |
| Indiana | 9.5 | 0 | 9.5 | 88 | 0 | 88 | 97 | 0 | 97 | 5.8 | 0 | 5.8 |
| Iowa | .7 | 0 | .7 | 33 | 0 | 33 | 34 | 0 | 34 | 0 | 0 | 0 |
| Kansas | 25 | 0 | 25 | .9 | 0 | .9 | 26 | 0 | 26 | 10 | 0 | 10 |
| Kentucky | 5.2 | 0 | 5.2 | 13 | 0 | 13 | 18 | 0 | 18 | .5 | 0 | .5 |
| Louisiana | .4 | 0 | .4 | 36 | 0 | 36 | 37 | 0 | 37 | 3.8 | 0 | 3.8 |
| Maine | .7 | 0 | .7 | 2.9 | 0 | 2.9 | 3.7 | 0 | 3.7 | .5 | 0 | .5 |
| Maryland | 21 | 0 | 21 | 7.5 | 21 | 29 | 28 | 21 | 49 | 5.6 | 21 | 26 |
| Massachusetts | 0 | 0 | 0 | 5.0 | 0 | 5.0 | 5.0 | 0 | 5.0 | 0 | 0 | 0 |
| Michigan | 8.8 | .9 | 9.7 | 46 | 0 | 46 | 55 | .9 | 56 | 2.1 | .1 | 2.2 |
| Minnesota | 2.4 | 0 | 2.4 | 217 | 0 | 217 | 220 | 0 | 220 | 57 | 0 | 57 |
| Mississippi | 2.9 | 0 | 2.9 | .5 | 0 | .5 | 3.4 | 0 | 3.4 | .8 | 0 | .8 |
| Missouri | 25 | .1 | 25 | .1 | 0 | .1 | 25 | .1 | 25 | 2.5 | 0 | 2.5 |
| Montana | 2.6 | 13 | 15 | 3.6 | 0 | 3.6 | 6.2 | 13 | 19 | 1.1 | 0 | 1.1 |
| Nebraska | 1.2 | 4.7 | 5.9 | 130 | 0 | 130 | 131 | 4.7 | 136 | 0 | 0 | 0 |
| Nevada | 45 | 12 | 57 | 3.5 | 0 | 3.5 | 49 | 12 | 61 | 49 | 12 | 61 |
| New Hampshire | .1 | 0 | .1 | 2.7 | 0 | 2.7 | 2.8 | 0 | 2.8 | .6 | 0 | .6 |
| New Jersey | 7.8 | 0 | 7.8 | 103 | 0 | 103 | 110 | 0 | 110 | 8.8 | 0 | 8.8 |
| New Mexico | 77 | 0 | 77 | 2.4 | 0 | 2.4 | 80 | 0 | 80 | 48 | 0 | 48 |
| New York | 11 | 1.5 | 13 | 34 | 15 | 49 | 45 | 16 | 62 | 13 | 4.4 | 17 |
| North Carolina | 68 | 0 | 68 | 28 | 0 | 28 | 96 | 0 | 96 | 6.4 | 0 | 6.4 |
| North Dakota | 3.0 | 0 | 3.0 | .7 | 0 | .7 | 3.7 | 0 | 3.7 | 3.0 | 0 | 3.0 |
| Ohio | 203 | 0 | 203 | 40 | 0 | 40 | 243 | 0 | 243 | 140 | 0 | 140 |
| Oklahoma | 2.2 | 243 | 245 | .5 | 0 | .5 | 2.8 | 243 | 246 | 2.7 | 0 | 2.7 |
| Oregon | 1.0 | 0 | 1.0 | .6 | 0 | .6 | 1.5 | 0 | 1.5 | .2 | 0 | .2 |
| Pennsylvania | 211 | 0 | 211 | 41 | 0 | 41 | 252 | 0 | 252 | 25 | 0 | 25 |
| Rhode Island | 0 | 0 | 0 | 6.8 | 0 | 6.8 | 6.8 | 0 | 6.8 | .7 | 0 | .7 |
| South Carolina | 8.0 | 0 | 8.0 | 3.6 | 0 | 3.6 | 12 | 0 | 12 | 1.2 | 0 | 1.2 |
| South Dakota | 15 | 0 | 15 | 23 | 0 | 23 | 38 | 0 | 38 | 9.5 | 0 | 9.5 |
| Tennessee | 8.2 | 0 | 8.2 | 82 | 0 | 82 | 90 | 0 | 90 | 9.9 | 0 | 9.9 |
| Texas | 93 | 491 | 584 | 46 | 0 | 46 | 139 | 491 | 630 | 138 | 0 | 138 |
| Utah | 37 | 5.0 | 42 | 3.6 | 93 | 96 | 41 | 98 | 138 | 16 | 94 | 109 |
| Vermont | .3 | 0 | .3 | 3.4 | 0 | 3.4 | 3.7 | 0 | 3.7 | .7 | 0 | .7 |
| Virginia | 23 | 0 | 23 | 68 | 0 | 68 | 91 | 0 | 91 | 11 | 0 | 11 |
| Washington | 2.4 | 0 | 2.4 | .6 | 0 | .6 | 3.0 | 0 | 3.0 | .4 | 0 | .4 |
| West Virginia | 527 | 0 | 527 | 0 | 0 | 0 | 527 | 0 | 527 | 369 | 0 | 369 |
| Wisconsin | .2 | 0 | .2 | 0 | 0 | 0 | .2 | 0 | .2 | 0 | 0 | 0 |
| Wyoming | 75 | 19 | 95 | 26 | 0 | 26 | 101 | 19 | 121 | 35 | 0 | 35 |
| Puerto Rico | 1.9 | 0 | 1.9 | .7 | 0 | .7 | 2.6 | 0 | 2.6 | .8 | 0 | .8 |
| Virgin Islands | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 2,020 | 1,210 | 3,240 | 1,280 | 438 | 1,720 | 3,310 | 1,650 | 4,960 | 1,160 | 393 | 1,550 |

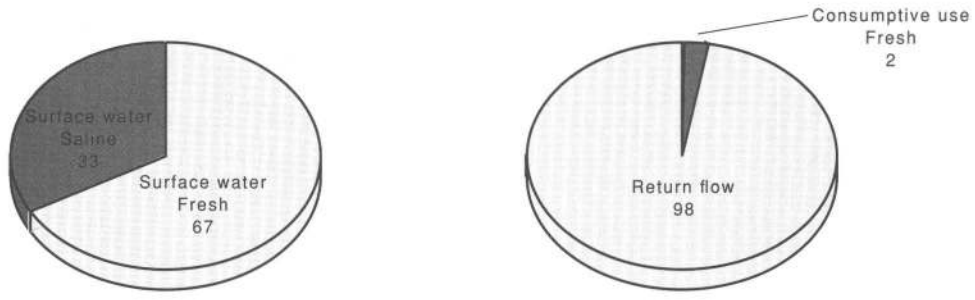
# Thermoelectric Power

The thermoelectric power category includes water used in the generation of electric power with fossil-fuel, nuclear, or geothermal energy. The estimates of water withdrawals for thermoelectric power should be reliable because relatively complete files on power generation are maintained by Federal and State agencies. The Electric Power Annual is prepared by the U.S. Department of Energy, Energy Information Administration, and contains information about electric power net generation. Most of the water withdrawn by thermoelectric plants is used for condenser and reactor cooling. Plants vary widely as to the techniques used in the disposal of the cooling water after it is passed through the condensers. Less water is required when cooling water is recycled through cooling towers or ponds, but a higher percentage of the cooling water is evaporated (consumptive use), usually more than 60 percent. When the water withdrawn for cooling is used only once before it is returned to a surface water body, significantly more water is required, but evaporation is low (less than 3 percent). Water-withdrawal estimates generally were made based on power generation. Consumptive use estimates were based on coefficients ranging from 1 to 100 percent of withdrawals.

The quantity of water used for thermoelectric power generation during 1990 was 131,000 Mgal/d of freshwater (the same quantity as in 1985), and an additional 64,500 Mgal/d of saline water (tables 23, 24) (15 percent more than in 1985). Thermoelectric power accounts for 39 percent of total freshwater use for all offstream categories and represents 48 percent of combined fresh and saline withdrawals. Fossil-fuel thermoelectric plants accounted for about 73 percent of total thermoelectric withdrawals; nuclear plants, 27 percent; and geothermal plants, less than 1 percent. Saline ground water was only reported for geothermal plants in California (41 Mgal/d), Nevada (32 Mgal/d), North Dakota (0.3 Mgal/d), and Utah (7.9 Mgal/d), and is not listed in the tables or included in the totals. Thermoelectric fresh and saline withdrawals were about 1.4 times the water withdrawn for irrigation, the next largest category.

The source and disposition of water for thermoelectric power are shown in the chart below. Surface water was the source for more than 99 percent of total thermoelectric withdrawals, and about 33 percent of the surface-water withdrawal was saline. Thermoelectric power plants furnish most of their own water; less than 0.1 percent is obtained from public supplies. About 2 percent of the water withdrawn for thermoelectric power (fossil fuel, nuclear) during 1990 was consumptively used as a result of once-through, cooling-tower, or pond cooling.

About five times more water was used in 1990 for thermoelectric power generation in the eastern part of the United States than in the western part to generate about twice as much power. The Mid Atlantic and South Atlantic-Gulf water-resources regions, where surface water is plentiful, led the nation in both fresh and saline withdrawals (figure 23). By State, New York, Illinois, California, Florida, Texas, Ohio, and New Jersey accounted for about 43 percent of total thermoelectric withdrawals (figure 27). Illinois and Ohio led the nation in freshwater withdrawals for themoelectric power generation (figure 28).




195,000 MILLION GALLONS PER DAY

THERMOELECTRIC POWER SOURCE AND DISPOSITION, 1990, IN PERCENT

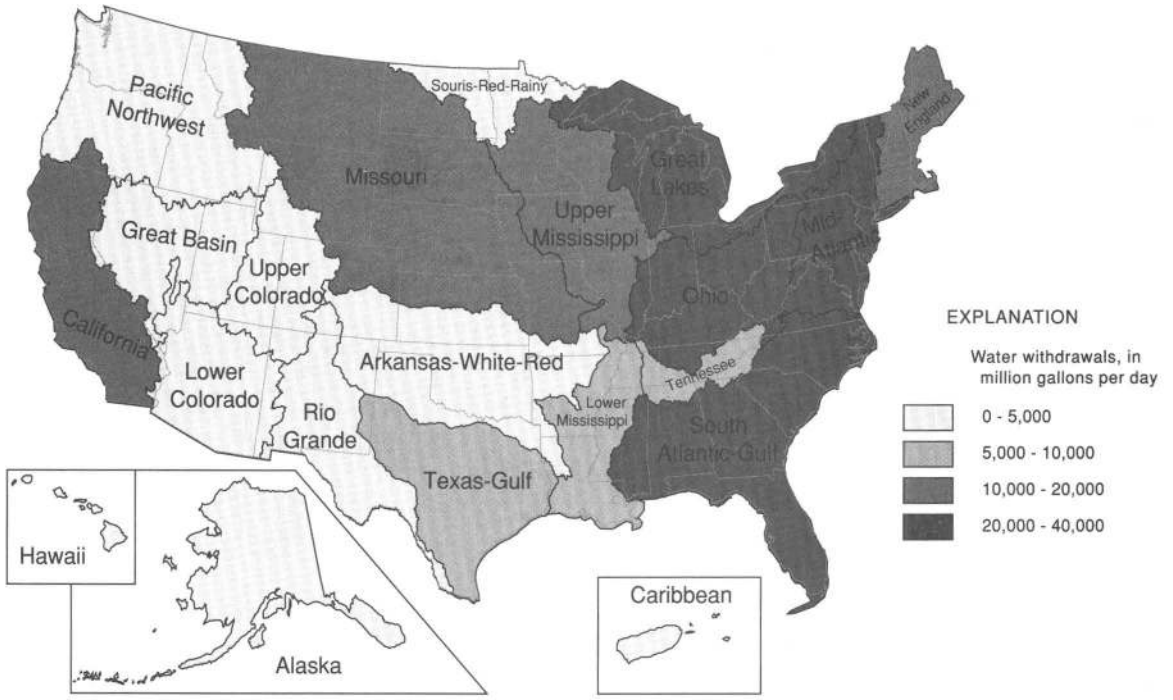



**Figure 26**. Thermoelectric power water withdrawals (fresh, saline) by water-resources region, 1990.

**Table 23**. Thermoelectric power water use by water-resources region, 1990

[Figures may not add to totals because of independent rounding. Mgal/d = million gallons per day; kWh = kilowatthour]

| REGION | ALL THERMOELECTRIC POWER WATER USE, in Mgal/d | | | | | | | | | POWER GENERATED, in million kWh |
|---|---|---|---|---|---|---|---|---|---|---|
| | Self-supplied withdrawals, by source and type | | | | Public-supply deliveries | Total use: Withdrawals and deliveries | Total use: Consumptive use | | | |
| | Ground water | Surface water | | | | | | | | |
| | Fresh | Fresh | Saline | Total | Fresh | Fresh | Fresh | Saline | Total | |
| New England | 2.9 | 2,400 | 9,090 | 11,500 | 6.6 | 2,410 | 48 | 182 | 230 | 93,000 |
| Mid Atlantic | 4.6 | 12,200 | 25,000 | 37,200 | 1.1 | 12,200 | 187 | 226 | 413 | 279,000 |
| South Atlantic-Gulf | 41 | 19,700 | 10,700 | 30,300 | 6.1 | 19,700 | 272 | 1.6 | 273 | 404,000 |
| Great Lakes | 3.2 | 22,800 | 0 | 22,800 | .1 | 22,800 | 476 | 0 | 476 | 179,000 |
| Ohio | 65 | 23,800 | 0 | 23,800 | .9 | 23,900 | 881 | 0 | 881 | 436,000 |
| Tennessee | 0 | 7,070 | 0 | 7,070 | 0 | 7,070 | 15 | 0 | 15 | 60,800 |
| Upper Mississippi | 21 | 16,500 | 0 | 16,500 | 5.8 | 16,500 | 635 | 0 | 635 | 194,000 |
| Lower Mississippi | 75 | 5,570 | 1,060 | 6,620 | .7 | 5,640 | 87 | 42 | 129 | 73,500 |
| Souris-Red-Rainy | 0 | 26 | 0 | 26 | 0 | 26 | .6 | 0 | .6 | 338 |
| Missouri Basin | 50 | 9,980 | 0 | 9,980 | 7.0 | 10,000 | 195 | 0 | 195 | 159,000 |
| Arkansas-White-Red | 31 | 4,500 | 0 | 4,500 | 26 | 4,550 | 144 | 0 | 144 | 132,000 |
| Texas-Gulf | 46 | 4,660 | 3,150 | 7,820 | 7.1 | 4,720 | 207 | 9.4 | 217 | 192,000 |
| Rio Grande | 16 | 1.8 | 0 | 1.8 | 0 | 18 | 12 | 0 | 12 | 7,780 |
| Upper Colorado | 0 | 177 | 0 | 177 | 0 | 177 | 165 | 0 | 165 | 91,400 |
| Lower Colorado | 47 | 62 | .4 | 62 | .8 | 110 | 107 | .4 | 107 | 54,000 |
| Great Basin | 7.2 | 24 | 0 | 24 | 0 | 31 | 31 | 0 | 31 | 17,300 |
| Pacific Northwest | 10 | 345 | 0 | 345 | 0 | 355 | 21 | 0 | 21 | 21,600 |
| California | 4.6 | 241 | 11,400 | 11,600 | 13 | 258 | 6.4 | 6.5 | 13 | 80,100 |
| Alaska | 4.7 | 26 | 0 | 26 | 1.0 | 32 | 3.2 | 0 | 3.2 | 3,820 |
| Hawaii | 95 | 0 | 1,550 | 1,550 | .4 | 96 | 1.7 | 15 | 17 | 8,320 |
| Caribbean | 2.6 | 0 | 2,570 | 2,570 | 3.3 | 5.9 | 1.1 | 1.1 | 2.1 | 15,000 |
| Total | 525 | 130,000 | 64,500 | 194,000 | 80 | 131,000 | 3,500 | 484 | 3,980 | 2,500,000 |


**Figure 27**. Thermoelectric power water withdrawals (fresh, saline) by State, 1990.


**Figure 28**. Thermoelectric power freshwater withdrawals by State, 1990.

**Table 24.** Thermoelectric power water use by State, 1990

[Figures may not add to totals because of independent rounding. Mgal/d = million gallons per day; kWh = kilowatthour]

| STATE | ALL THERMOELECTRIC POWER WATER USE, in Mgal/d | | | | | | | | | POWER GENERATED, in million kWh |
|---|---|---|---|---|---|---|---|---|---|---|
| | Self-supplied withdrawals, by source and type | | | | Public-supply deliveries | Total use | | | | |
| | Ground water | Surface water | | | | Withdrawals and deliveries | Consumptive use | | | |
| | Fresh | Fresh | Saline | Total | Fresh | Fresh | Fresh | Saline | Total | |
| Alabama | 0.0 | 6,310 | 0.0 | 6,310 | 0.0 | 6,310 | 44 | 0.0 | 44 | 66,400 |
| Alaska | 4.7 | 26 | 0 | 26 | 1.0 | 32 | 3.2 | 0 | 3.2 | 3,820 |
| Arizona | 42 | 61 | .4 | 62 | 0 | 103 | 100 | .4 | 101 | 55,900 |
| Arkansas | 2.4 | 1,640 | 0 | 1,640 | 0 | 1,640 | 13 | 0 | 13 | 34,500 |
| California | 4.6 | 241 | 11,400 | 11,600 | 13 | 258 | 6.4 | 6.5 | 13 | 80,100 |
| Colorado | 21 | 94 | 0 | 94 | 13 | 127 | 41 | 0 | 41 | 30,000 |
| Connecticut | .2 | 530 | 3,710 | 4,240 | 2.6 | 533 | 11 | 74 | 85 | 33,100 |
| Delaware | .5 | 830 | 333 | 1,160 | .9 | 831 | 5.0 | 1.5 | 6.6 | 6,640 |
| D.C. | 0 | 8.0 | 0 | 8.0 | 0 | 8.0 | .6 | 0 | .6 | 361 |
| Florida | 23 | 709 | 10,300 | 11,000 | 5.5 | 738 | 22 | 0 | 22 | 128,000 |
| Georgia | 5.2 | 3,020 | 33 | 3,060 | 0 | 3,030 | 98 | 0 | 98 | 92,700 |
| Hawaii | 95 | 0 | 1,550 | 1,550 | .4 | 96 | 1.7 | 15 | 17 | 8,320 |
| Idaho | 6.1 | 0 | 0 | 0 | 0 | 6.1 | 1.5 | 0 | 1.5 | 0 |
| Illinois | 9.0 | 15,200 | 0 | 15,200 | 1.3 | 15,200 | 370 | 0 | 370 | 128,000 |
| Indiana | 12 | 5,950 | 0 | 5,950 | 0 | 5,960 | 119 | 0 | 119 | 97,300 |
| Iowa | 12 | 2,060 | 0 | 2,060 | 4.7 | 2,080 | 10 | 0 | 10 | 29,000 |
| Kansas | 13 | 1,290 | 0 | 1,290 | .8 | 1,300 | 63 | 0 | 63 | 33,700 |
| Kentucky | 38 | 3,410 | 0 | 3,410 | 0 | 3,440 | 203 | 0 | 203 | 70,600 |
| Louisiana | 40 | 4,910 | 0 | 4,910 | 0 | 4,950 | 46 | 0 | 46 | 57,000 |
| Maine | 1.4 | 81 | 609 | 690 | 1.2 | 83 | 1.6 | 12 | 14 | 9,390 |
| Maryland | 1.8 | 419 | 4,550 | 4,970 | 0 | 421 | 4.2 | 54 | 59 | 29,100 |
| Massachusetts | .5 | 1,010 | 3,490 | 4,500 | 2.8 | 1,020 | 20 | 70 | 90 | 36,200 |
| Michigan | 2.8 | 8,050 | 0 | 8,050 | 0 | 8,060 | 204 | 0 | 204 | 68,600 |
| Minnesota | 2.4 | 1,880 | 0 | 1,880 | .5 | 1,880 | 323 | 0 | 323 | 42,700 |
| Mississippi | 43 | 342 | 316 | 658 | .3 | 386 | 52 | 1.6 | 54 | 21,800 |
| Missouri | 32 | 4,540 | 1,060 | 5,600 | .2 | 4,580 | 55 | 42 | 97 | 57,100 |
| Montana | 0 | 33 | 0 | 33 | 0 | 33 | 33 | 0 | 33 | 15,100 |
| Nebraska | 6.0 | 2,180 | 0 | 2,180 | 1.9 | 2,180 | 22 | 0 | 22 | 20,500 |
| Nevada | 12 | 22 | 0 | 22 | .8 | 34 | 34 | 0 | 34 | 19,100 |
| New Hampshire | .8 | 254 | 894 | 1,150 | 0 | 255 | 5.1 | 18 | 23 | 10,200 |
| New Jersey | 1.6 | 597 | 9,550 | 10,100 | .2 | 599 | .2 | 0 | .2 | 36,500 |
| New Mexico | 9.9 | 40 | 0 | 40 | .1 | 50 | 46 | 0 | 46 | 28,300 |
| New York | 0 | 6,990 | 8,470 | 15,500 | 0 | 6,990 | 171 | 170 | 340 | 105,000 |
| North Carolina | 0 | 7,210 | 0 | 7,210 | .4 | 7,210 | 43 | 0 | 43 | 73,000 |
| North Dakota | .1 | 2,390 | 0 | 2,390 | 0 | 2,390 | 26 | 0 | 26 | 26,900 |
| Ohio | 13 | 9,540 | 0 | 9,540 | 0 | 9,550 | 393 | 0 | 393 | 126,000 |
| Oklahoma | 1.8 | 88 | 0 | 88 | 1.5 | 91 | 48 | 0 | 48 | 41,500 |
| Oregon | 0 | 15 | 0 | 15 | 0 | 15 | 11 | 0 | 11 | 8,040 |
| Pennsylvania | 0 | 5,750 | 0 | 5,750 | 0 | 5,750 | 218 | 0 | 218 | 162,000 |
| Rhode Island | 0 | 0 | 393 | 393 | 0 | 0 | 0 | 7.9 | 7.9 | 591 |
| South Carolina | 1.4 | 4,820 | 0 | 4,820 | 0 | 4,820 | 55 | 0 | 55 | 48,200 |
| South Dakota | .4 | 2.8 | 0 | 2.8 | 0 | 3.2 | .1 | 0 | .1 | 2,490 |
| Tennessee | 0 | 7,320 | 0 | 7,320 | .5 | 7,320 | 0 | 0 | 0 | 64,300 |
| Texas | 54 | 7,070 | 3,150 | 10,200 | 22 | 7,150 | 247 | 9.4 | 257 | 224,000 |
| Utah | 0 | 87 | 0 | 87 | 0 | 87 | 86 | 0 | 86 | 31,600 |
| Vermont | .4 | 518 | 0 | 518 | .1 | 519 | 11 | 0 | 11 | 3,780 |
| Virginia | .4 | 3,210 | 2,080 | 5,290 | 0 | 3,210 | 12 | 0 | 12 | 46,600 |
| Washington | 4.0 | 330 | 0 | 330 | 0 | 334 | 8.8 | 0 | 8.8 | 13,500 |
| West Virginia | .4 | 3,710 | 0 | 3,710 | .9 | 3,710 | 99 | 0 | 99 | 84,600 |
| Wisconsin | 2.4 | 5,090 | 0 | 5,090 | 0 | 5,100 | 51 | 0 | 51 | 40,900 |
| Wyoming | 1.0 | 183 | 0 | 183 | 0 | 184 | 54 | 0 | 54 | 35,800 |
| Puerto Rico | 2.6 | 0 | 2,470 | 2,470 | 2.8 | 5.4 | 1.1 | 0 | 1.1 | 14,500 |
| Virgin Islands | 0 | 0 | 103 | 103 | .5 | .5 | 0 | 1.1 | 1.1 | 460 |
| Total | 525 | 130,000 | 64,500 | 194,000 | 80 | 131,000 | 3,500 | 484 | 3,980 | 2,500,000 |

**Table 25.** Thermoelectric power water use by energy source and water-resources region, 1990

[Figures may not add to totals because of independent rounding. All values in million gallons per day]

| REGION | FOSSIL FUEL | | | | | | NUCLEAR | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Withdrawals, by source and type | | | | Consumptive use | | Withdrawals, by source and type | | | | Consumptive use | |
| | Ground water | Surface water | | | | | Ground water | Surface water | | | | |
| | Fresh | Fresh | Saline | Total | Fresh | Saline | Fresh | Fresh | Saline | Total | Fresh | Saline |
| New England | 2.8 | 1,380 | 5,290 | 6,670 | 28 | 106 | 0.1 | 1,020 | 3,800 | 4,820 | 21 | 76 |
| Mid Atlantic | 3.6 | 9,130 | 13,400 | 22,500 | 111 | 180 | .9 | 3,040 | 11,600 | 14,600 | 76 | 45 |
| South Atlantic-Gulf | 37 | 12,300 | 8,840 | 21,200 | 165 | 1.6 | 3.9 | 7,330 | 1,820 | 9,150 | 107 | 0 |
| Great Lakes | 3.1 | 15,200 | 0 | 15,200 | 245 | 0 | .1 | 7,620 | 0 | 7,620 | 230 | 0 |
| Ohio | 65 | 23,800 | 0 | 23,800 | 852 | 0 | 0 | 65 | 0 | 65 | 30 | 0 |
| Tennessee | 0 | 5,130 | 0 | 5,130 | 14 | 0 | 0 | 1,930 | 0 | 1,930 | 1.0 | 0 |
| Upper Mississippi | 16 | 11,800 | 0 | 11,800 | 454 | 0 | 4.6 | 4,630 | 0 | 4,630 | 181 | 0 |
| Lower Mississippi | 44 | 4,480 | 1,060 | 5,540 | 50 | 42 | 30 | 1,090 | 0 | 1,090 | 37 | 0 |
| Souris-Red-Rainy | 0 | 26 | 0 | 26 | .6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Missouri Basin | 50 | 8,970 | 0 | 8,970 | 169 | 0 | 0 | 1,010 | 0 | 1,010 | 26 | 0 |
| Arkansas-White-Red | 31 | 3,570 | 0 | 3,570 | 125 | 0 | 0 | 923 | 0 | 923 | 18 | 0 |
| Texas-Gulf | 44 | 4,610 | 3,150 | 7,760 | 153 | 9.4 | 1.3 | 53 | 0 | 53 | 54 | 0 |
| Rio Grande | 16 | 1.8 | 0 | 1.8 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Upper Colorado | 0 | 177 | 0 | 177 | 165 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lower Colorado | 47 | 19 | .4 | 20 | 66 | .4 | .1 | 43 | 0 | 43 | 40 | 0 |
| Great Basin | 7.2 | 24 | 0 | 24 | 31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pacific Northwest | 4.0 | 34 | 0 | 34 | 1.6 | 0 | 6.1 | 311 | 0 | 311 | 19 | 0 |
| California | 4.5 | 241 | 5,910 | 6,150 | 6.2 | 5.9 | .1 | .1 | 5,500 | 5,500 | .3 | .6 |
| Alaska | 4.7 | 26 | 0 | 26 | 3.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hawaii | 95 | 0 | 1,550 | 1,550 | 1.7 | 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| Caribbean | 2.6 | 0 | 2,570 | 2,570 | 1.1 | 1.1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 478 | 101,000 | 41,700 | 143,000 | 2,650 | 362 | 48 | 29,100 | 22,700 | 51,800 | 841 | 122 |

**Table 26.** Thermoelectric power water use by energy source and State, 1990

[Figures may not add to totals because of independent rounding. All values in million gallons per day]

| STATE | FOSSIL FUEL | | | | | | NUCLEAR | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Withdrawals, by source and type | | | | Consumptive use | | Withdrawals, by source and type | | | | Consumptive use | |
| | Ground water | Surface water | | | | | Ground water | Surface water | | | | |
| | Fresh | Fresh | Saline | Total | Fresh | Saline | Fresh | Fresh | Saline | Total | Fresh | Saline |
| Alabama | 0.0 | 5,570 | 0.0 | 5,570 | 30 | 0.0 | 0.0 | 738 | 0.0 | 738 | 14 | 0.0 |
| Alaska | 4.7 | 26 | 0 | 26 | 3.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Arizona | 42 | 18 | .4 | 19 | 60 | .4 | .1 | 43 | 0 | 43 | 40 | 0 |
| Arkansas | 2.4 | 737 | 0 | 737 | 12 | 0 | 0 | 902 | 0 | 902 | 1.1 | 0 |
| California | 4.5 | 241 | 5,910 | 6,150 | 6.2 | 5.9 | .1 | .1 | 5,500 | 5,500 | .3 | .6 |
| Colorado | 21 | 94 | 0 | 94 | 41 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Connecticut | .1 | 155 | 1,390 | 1,540 | 3.1 | 28 | .1 | 375 | 2,320 | 2,690 | 7.5 | 46 |
| Delaware | .5 | 830 | 333 | 1,160 | 5.0 | 1.5 | 0 | 0 | 0 | 0 | 0 | 0 |
| D.C. | 0 | 8.0 | 0 | 8.0 | .6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Florida | 23 | 709 | 8,490 | 9,200 | 21 | 0 | .3 | 0 | 1,820 | 1,820 | 1.0 | 0 |
| Georgia | 2.7 | 2,900 | 33 | 2,940 | 48 | 0 | 2.5 | 119 | 0 | 119 | 50 | 0 |
| Hawaii | 95 | 0 | 1,550 | 1,550 | 1.7 | 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| Idaho | 0 | 0 | 0 | 0 | 0 | 0 | 6.1 | 0 | 0 | 0 | 1.5 | 0 |
| Illinois | 6.2 | 9,190 | 0 | 9,190 | 148 | 0 | 2.8 | 5,970 | 0 | 5,970 | 222 | 0 |
| Indiana | 12 | 5,950 | 0 | 5,950 | 119 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Iowa | 10 | 2,060 | 0 | 2,060 | 6.9 | 0 | 1.8 | 3.3 | 0 | 3.3 | 3.4 | 0 |
| Kansas | 13 | 1,270 | 0 | 1,270 | 46 | 0 | 0 | 22 | 0 | 22 | 17 | 0 |
| Kentucky | 38 | 3,410 | 0 | 3,410 | 203 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Louisiana | 40 | 3,820 | 0 | 3,820 | 32 | 0 | .1 | 1,090 | 0 | 1,090 | 14 | 0 |
| Maine | 1.4 | 81 | 4.0 | 85 | 1.6 | .1 | 0 | 0 | 605 | 605 | 0 | 12 |
| Maryland | 1.8 | 419 | 3,420 | 3,840 | 4.2 | 43 | .1 | 0 | 1,130 | 1,130 | 0 | 11 |
| Massachusetts | .5 | 889 | 3,160 | 4,050 | 18 | 63 | 0 | 124 | 324 | 448 | 2.5 | 6.5 |
| Michigan | 2.8 | 5,460 | 0 | 5,460 | 125 | 0 | 0 | 2,600 | 0 | 2,600 | 78 | 0 |
| Minnesota | 2.4 | 1,080 | 0 | 1,080 | 303 | 0 | 0 | 800 | 0 | 800 | 19 | 0 |
| Mississippi | 13 | 342 | 316 | 658 | 30 | 1.6 | 30 | 0 | 0 | 0 | 23 | 0 |
| Missouri | 32 | 4,530 | 1,060 | 5,590 | 40 | 42 | 0 | 15 | 0 | 15 | 15 | 0 |
| Montana | 0 | 33 | 0 | 33 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nebraska | 6.0 | 1,180 | 0 | 1,180 | 11 | 0 | 0 | 1,000 | 0 | 1,000 | 11 | 0 |
| Nevada | 12 | 22 | 0 | 22 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Hampshire | .8 | 254 | 339 | 593 | 5.1 | 6.8 | 0 | 0 | 555 | 555 | 0 | 11 |
| New Jersey | 1.0 | 597 | 1,620 | 2,220 | .2 | 0 | .7 | 0 | 7,930 | 7,930 | 0 | 0 |
| New Mexico | 9.9 | 40 | 0 | 40 | 46 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New York | 0 | 5,870 | 6,770 | 12,600 | 117 | 136 | 0 | 1,130 | 1,700 | 2,830 | 53 | 34 |
| North Carolina | 0 | 3,250 | 0 | 3,250 | 25 | 0 | 0 | 3,960 | 0 | 3,960 | 17 | 0 |
| North Dakota | .1 | 2,390 | 0 | 2,390 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ohio | 13 | 9,400 | 0 | 9,400 | 375 | 0 | 0 | 138 | 0 | 138 | 18 | 0 |
| Oklahoma | 1.8 | 88 | 0 | 88 | 48 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Oregon | 0 | .8 | 0 | .8 | .8 | 0 | 0 | 14 | 0 | 14 | 9.9 | 0 |
| Pennsylvania | 0 | 3,970 | 0 | 3,970 | 113 | 0 | 0 | 1,780 | 0 | 1,780 | 105 | 0 |
| Rhode Island | 0 | 0 | 393 | 393 | 0 | 7.9 | 0 | 0 | 0 | 0 | 0 | 0 |
| South Carolina | .2 | 1,660 | 0 | 1,660 | 30 | 0 | 1.2 | 3,160 | 0 | 3,160 | 25 | 0 |
| South Dakota | .4 | 2.8 | 0 | 2.8 | .1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tennessee | 0 | 6,020 | 0 | 6,020 | 0 | 0 | 0 | 1,300 | 0 | 1,300 | 0 | 0 |
| Texas | 53 | 7,020 | 3,150 | 10,200 | 193 | 9.4 | 1.3 | 53 | 0 | 53 | 54 | 0 |
| Utah | 0 | 87 | 0 | 87 | 86 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Vermont | .4 | .1 | 0 | .1 | 0 | 0 | 0 | 518 | 0 | 518 | 11 | 0 |
| Virginia | .3 | 1,880 | 1,230 | 3,110 | 12 | 0 | .2 | 1,330 | 846 | 2,170 | 0 | 0 |
| Washington | 4.0 | 34 | 0 | 34 | .8 | 0 | 0 | 296 | 0 | 296 | 8.1 | 0 |
| West Virginia | .4 | 3,710 | 0 | 3,710 | 99 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wisconsin | 2.3 | 3,480 | 0 | 3,480 | 35 | 0 | .1 | 1,620 | 0 | 1,620 | 16 | 0 |
| Wyoming | 1.0 | 183 | 0 | 183 | 54 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Puerto Rico | 2.6 | 0 | 2,470 | 2,470 | 1.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Virgin Islands | 0 | 0 | 103 | 103 | 0 | 1.1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 478 | 101,000 | 41,700 | 143,000 | 2,650 | 362 | 48 | 29,100 | 22,700 | 51,800 | 841 | 122 |

# INSTREAM USE

## Hydroelectric Power

Water used for hydroelectric power generation is classified as an instream use and refers to the water used in the generation of electricity at plants where the turbine generators are driven by falling water. Estimates of water used for hydroelectric power generation may vary because of the way individual estimates are made of the quantities of water passed through the plants. If the water is passed through the plants only one time, then accurate estimates of water use can be obtained by streamflow measurements and gate openings. However, it is difficult to define and obtain net water use at pumped-storage hydroelectric plants because the same water is recycled a number of times. Pumped-storage plants usually generate electric energy during peak-load periods by using water previously pumped into an elevated storage reservoir during off-peak periods when excess generating capacity is available to do so. When additional generating capacity is needed, the water can be released from the pumped-storage reservoir through a conduit to turbine generators located in a power plant at a lower level.

Estimates of hydroelectric power water use and power generation, as with the thermoelectric power category, are based on more information and fewer extrapolations than for the other water-use categories. Most of the information was obtained from hydroelectric utility companies. If information was not available from utilities, then records of the power generated were obtained from the U.S. Department of Energy's Energy Information Administration (1991). The power-generation data were multiplied by water-use coefficients to obtain estimates of hydroelectric power water use. In this report, it is assumed that none of the water used for hydroelectric power generation is consumptively used. Although the quantity of water evaporated in the actual generation of hydroelectric power (consumptive use) is very small, considerable depletion of the available water supply for hydroelectric power generation occurs as an indirect result of evaporation from reservoirs and repeated reuse of water within a pumped-storage power facility.

Water used for hydroelectric power generation during 1990 was an estimated 3,290,000 Mgal/d (tables 27, 28), or 8 percent more than during 1985. This total is 2.6 times the average annual runoff in the conterminous United States. (Graczyk and others, 1988). It is possible for the hydroelectric power water use to exceed average annual runoff because some water is used several times as it passes through several hydroelectric dams on a river.

Fresh surface water provides virtually all water for hydroelectric power generation. The Pacific Northwest water-resources region had by far the largest use of water for hydroelectric power generation during 1990, more than double the use in the Great Lakes region (figure 29), and accounted for about 38 percent of the water used for hydroelectric power generation in the Nation. Almost one half of the water used for hydroelectric power generation in the United States occurred in Washington, Oregon (figure 30), primarily on the Columbia River system, and New York on the Niagara and the St. Lawrence River systems.

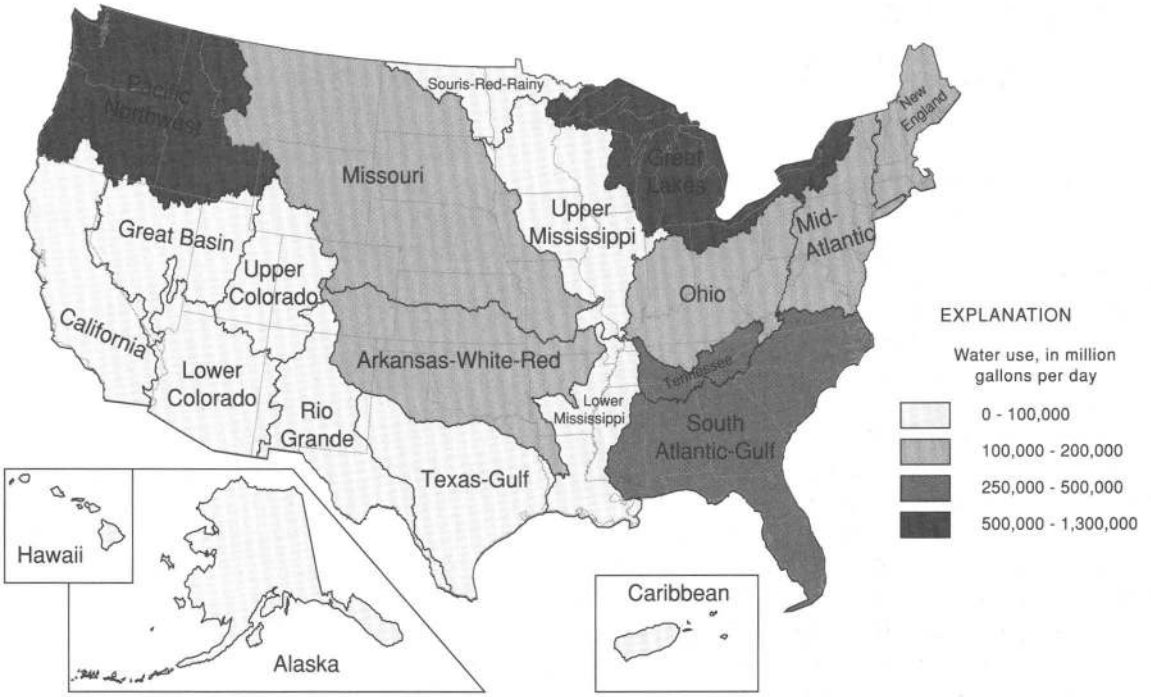



**Figure 29**. Hydroelectric power water use by water-resources region, 1990.

**Table 27.** Hydroelectric power water use by water-resources region, 1990

[Figures may not add to totals because of independent rounding.
Mgal/d = million gallons per day; kWh = kilowatthour]

| REGION | WATER USE | | POWER GENERATED, in million kWh |
|---|---|---|---|
| | Mgal/d | Thousand acre-feet per year | |
| New England | 168,000 | 188,000 | 8,080 |
| Mid Atlantic | 192,000 | 215,000 | 11,700 |
| South Atlantic-Gulf | 275,000 | 308,000 | 18,500 |
| Great Lakes | 506,000 | 567,000 | 30,100 |
| Ohio | 147,000 | 165,000 | 5,860 |
| Tennessee | 294,000 | 330,000 | 19,700 |
| Upper Mississippi | 73,200 | 82,100 | 2,200 |
| Lower Mississippi | 26,600 | 29,800 | 1,250 |
| Souris-Red-Rainy | 1,280 | 1,430 | 45 |
| Missouri Basin | 109,000 | 122,000 | 12,600 |
| Arkansas-White-Red | 109,000 | 122,000 | 8,370 |
| Texas-Gulf | 12,100 | 13,600 | 953 |
| Rio Grande | 3,520 | 3,950 | 569 |
| Upper Colorado | 11,900 | 13,300 | 4,760 |
| Lower Colorado | 34,700 | 38,900 | 6,640 |
| Great Basin | 2,360 | 2,650 | 284 |
| Pacific Northwest | 1,250,000 | 1,400,000 | 142,000 |
| California | 69,000 | 77,300 | 23,700 |
| Alaska | 1,790 | 2,010 | 980 |
| Hawaii | 264 | 296 | 89 |
| Caribbean | 362 | 406 | 108 |
| Total | 3,290,000 | 3,690,000 | 299,000 |


**Figure 30.** Hydroelectric power water use by State, 1990.

**Table 28.** Hydroelectric power water use by State, 1990

[Figures may not add to totals because of independent rounding.
Mgal/d = million gallons per day; kWh = kilowatthour]

| STATE | WATER USE | | POWER GENERATED, in million kWh |
|---|---|---|---|
| | Mgal/d | Thousand acre-feet per year | |
| Alabama | 218,000 | 244,000 | 10,300 |
| Alaska | 1,790 | 2,010 | 980 |
| Arizona | 31,800 | 35,600 | 8,180 |
| Arkansas | 60,400 | 67,700 | 4,890 |
| California | 75,000 | 84,100 | 23,900 |
| Colorado | 4,160 | 4,660 | 1,320 |
| Connecticut | 6,870 | 7,700 | 452 |
| Delaware | 0 | 0 | 0 |
| D.C. | 0 | 0 | 0 |
| Florida | 7,260 | 8,140 | 173 |
| Georgia | 51,700 | 58,000 | 4,710 |
| Hawaii | 264 | 296 | 89 |
| Idaho | 67,800 | 76,000 | 7,450 |
| Illinois | 27,100 | 30,400 | 771 |
| Indiana | 11,600 | 13,000 | 441 |
| Iowa | 1,150 | 1,290 | 13 |
| Kansas | 1,300 | 1,460 | 12 |
| Kentucky | 83,000 | 93,000 | 2,880 |
| Louisiana | 21,700 | 24,300 | 697 |
| Maine | 82,700 | 92,700 | 3,960 |
| Maryland | 25,900 | 29,000 | 2,310 |
| Massachusetts | 24,500 | 27,500 | 1,090 |
| Michigan | 110,000 | 123,000 | 3,040 |
| Minnesota | 18,800 | 21,100 | 843 |
| Mississippi | 0 | 0 | 0 |
| Missouri | 13,900 | 15,600 | 2,190 |
| Montana | 66,800 | 74,900 | 10,700 |
| Nebraska | 12,900 | 14,500 | 833 |
| Nevada | 3,490 | 3,910 | 1,620 |
| New Hampshire | 46,000 | 51,600 | 1,980 |
| New Jersey | 167 | 187 | 17 |
| New Mexico | 964 | 1,080 | 215 |
| New York | 459,000 | 515,000 | 29,400 |
| North Carolina | 66,900 | 75,000 | 7,070 |
| North Dakota | 10,900 | 12,200 | 1,720 |
| Ohio | 7,800 | 8,740 | 173 |
| Oklahoma | 47,900 | 53,700 | 2,870 |
| Oregon | 481,000 | 539,000 | 40,800 |
| Pennsylvania | 68,000 | 76,200 | 3,190 |
| Rhode Island | 339 | 380 | 6.1 |
| South Carolina | 63,400 | 71,100 | 3,880 |
| South Dakota | 41,100 | 46,100 | 4,270 |
| Tennessee | 160,000 | 179,000 | 11,800 |
| Texas | 15,800 | 17,700 | 1,570 |
| Utah | 1,880 | 2,110 | 481 |
| Vermont | 17,700 | 19,800 | 1,100 |
| Virginia | 22,900 | 25,700 | 4,050 |
| Washington | 670,000 | 751,000 | 87,300 |
| West Virginia | 32,700 | 36,700 | 1,330 |
| Wisconsin | 44,000 | 49,300 | 1,150 |
| Wyoming | 4,350 | 4,880 | 611 |
| Puerto Rico | 362 | 406 | 108 |
| Virgin Islands | 0 | 0 | 0 |
| Total | 3,290,000 | 3,690,000 | 299,000 |

# Wastewater Release

## Wastewater Treatment

In addition to water withdrawals, public-supply deliveries, and consumptive use, the term "water use" also includes wastewater releases and return flow. Because quality as well as quantity considerations are increasingly important in water management, more information is needed concerning the location of wastewater-treatment facilities and the quantities of treated wastewater released from the facilities and returned to the hydrologic system.

The wastewater treatment category includes information on facilities engaged primarily in the collection, treatment, and disposal of wastewater conveyed through a sewer system. Return of treated water generally is to surface waters. Treatment facilities are separated into two categories in this report: publicly owned (municipal) treatment works and "other". Publicly-owned treatment works are publicly owned or receive some form of public funding, and receive and treat wastewater from various users such as domestic, commercial, and industrial. Other wastewater facilities are privately owned and include commercial and industrial facilities that treat their own wastewater. Information on the quantities of water treated and released from publicly owned treatment facilities and returned directly to the hydrologic system, or released for beneficial reuse (reclaimed wastewater), are given in this report, along with the number of public and other wastewater-treatment facilities.

The release information usually is obtained from wastewater-treatment facility operators, utility departments, or from discharge permit files maintained by State or Federal agencies. Return flows to surface water usually are regulated by State or Federal agencies. The number of wastewater-treatment facilities typically is available from permit files at State or Federal agencies. The reliability of the data varies by State depending on available information.

About 19,600 public-treatment facilities released about 35,300 Mgal/d of treated wastewater nationwide during 1990. (See tables 29, 30.) Nationally, an average of from 1 million to 2 million gallons of treated wastewater per public-treatment facility was returned daily to streams or other surface-water bodies. In addition, 928 Mgal/d of treated wastewater was reclaimed for beneficial uses such as irrigation of golf courses and public parks. The largest return flows occurred in regions (figure 31) and States (figure 32) that have large populations and large public-supply withdrawals. California and New York, which have large public-supply withdrawals, reported the largest releases of treated wastewater. California, Arizona, and Florida reported large uses of reclaimed wastewater.

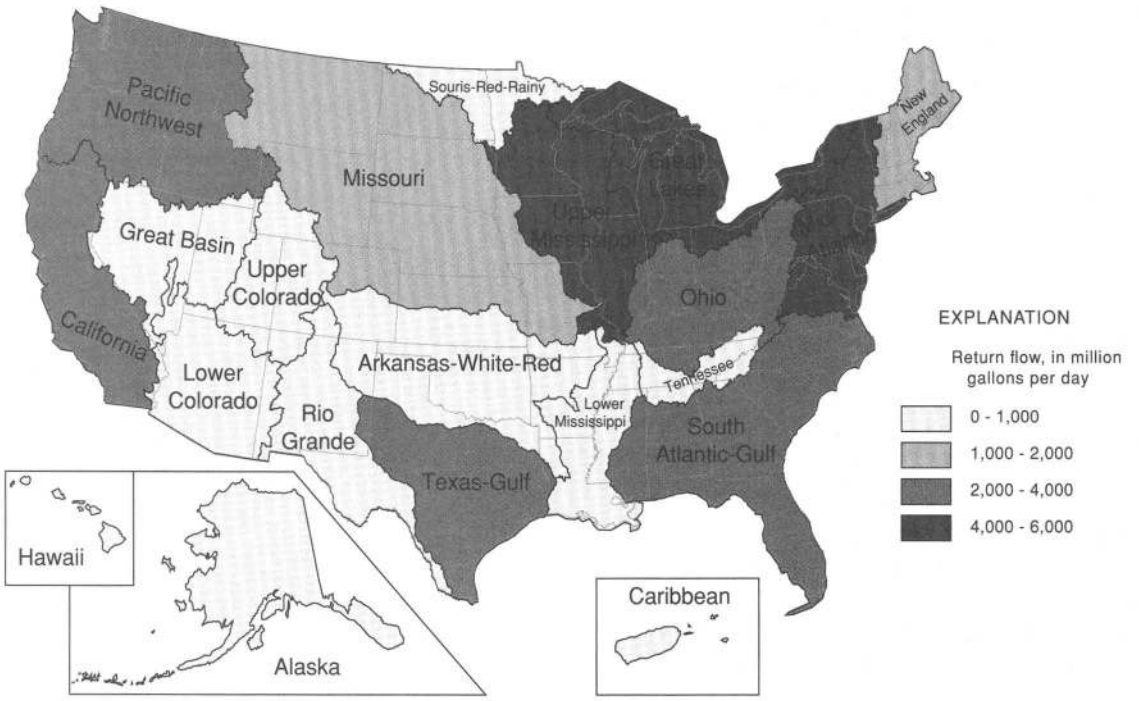



**Figure 31**. Wastewater treatment return flow by water-resources region, 1990.

**Table 29**. Wastewater treatment water releases by water-resources region, 1990

[Figures may not add to totals because of independent rounding.
Mgal/d = million gallons per day]

| REGION | NUMBER OF FACILITIES | | PUBLIC RELEASES | |
|---|---|---|---|---|
| | Public | Other | Return flow, in Mgal/d | Reclaimed wastewater, in Mgal/d |
| New England | 320 | 621 | 1,720 | 0.0 |
| Mid Atlantic | 1,423 | 2,409 | 5,740 | 63 |
| South Atlantic-Gulf | 2,349 | 2,744 | 3,590 | 238 |
| Great Lakes | 1,097 | 996 | 5,160 | 0 |
| Ohio | 2,317 | 3,179 | 2,850 | 0 |
| Tennessee | 213 | 464 | 519 | .1 |
| Upper Mississippi | 2,395 | 1,683 | 4,070 | 0 |
| Lower Mississippi | 891 | 974 | 702 | 0 |
| Souris-Red-Rainy | 260 | 68 | 34 | 0 |
| Missouri Basin | 1,970 | 1,412 | 1,290 | 6.4 |
| Arkansas-White-Red | 1,200 | 1,160 | 874 | 13 |
| Texas-Gulf | 2,737 | 2,708 | 2,000 | 50 |
| Rio Grande | 216 | 136 | 161 | 4.4 |
| Upper Colorado | 123 | 110 | 86 | .4 |
| Lower Colorado | 150 | 97 | 625 | 230 |
| Great Basin | 112 | 84 | 366 | 52 |
| Pacific Northwest | 630 | 828 | 2,180 | 11 |
| California | 1,049 | 833 | 2,990 | 255 |
| Alaska | 21 | 39 | 57 | 0 |
| Hawaii | 26 | 128 | 144 | 5.8 |
| Caribbean | 92 | 2 | 138 | 0 |
| Total | 19,591 | 20,675 | 35,300 | 928 |

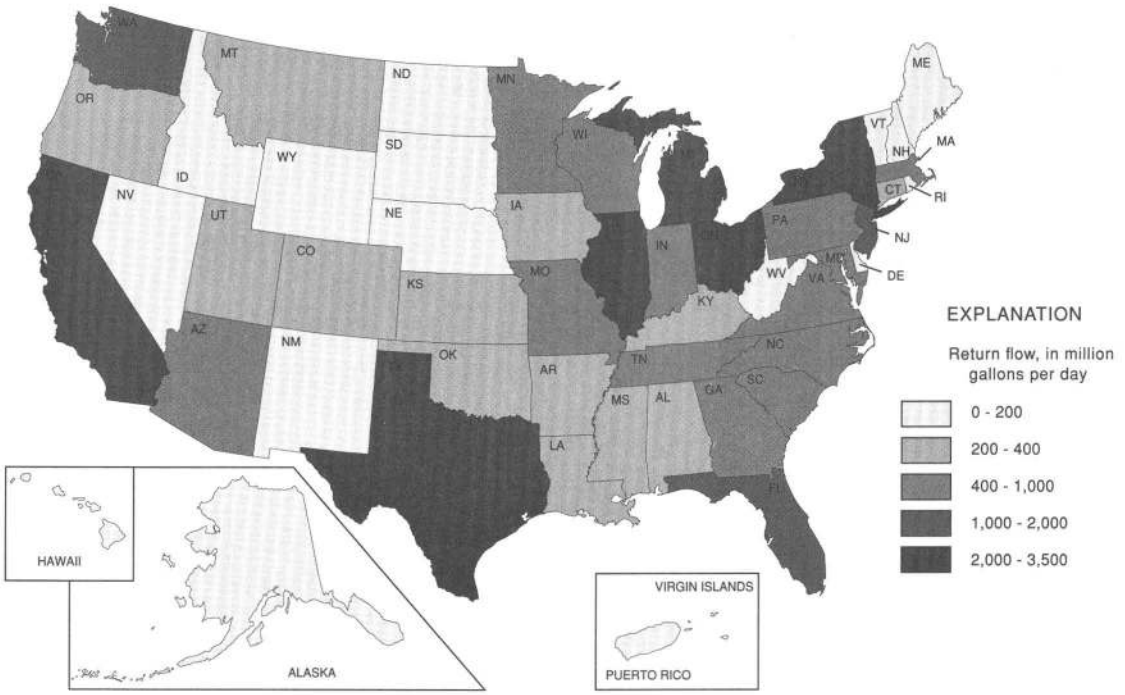



**Figure 32.** Wastewater treatment return flow by State, 1990.

## Table 30. Wastewater treatment water releases by State, 1990

[Figures may not add to totals because of independent rounding.
Mgal/d = million gallons per day]

| STATE | NUMBER OF FACILITIES | | PUBLIC RELEASES | |
|---|---|---|---|---|
| | Public | Other | Return flow, in Mgal/d | Reclaimed wastewater, in Mgal/d |
| Alabama | 104 | 0.0 | 391 | 0.0 |
| Alaska | 21 | 39 | 57 | 0 |
| Arizona | 119 | 53 | 546 | 226 |
| Arkansas | 328 | 533 | 268 | 0 |
| California | 1,055 | 859 | 2,990 | 259 |
| Colorado | 223 | 179 | 361 | 7.1 |
| Connecticut | 98 | 46 | 364 | 0 |
| Delaware | 15 | 0 | 105 | 0 |
| D.C. | 1 | 21 | 317 | 0 |
| Florida | 780 | 271 | 1,350 | 174 |
| Georgia | 403 | 223 | 750 | 34 |
| Hawaii | 26 | 128 | 144 | 5.8 |
| Idaho | 134 | 0 | 132 | 0 |
| Illinois | 920 | 493 | 2,670 | 0 |
| Indiana | 542 | 320 | 838 | 0 |
| Iowa | 706 | 463 | 362 | 0 |
| Kansas | 432 | 164 | 220 | 7.7 |
| Kentucky | 223 | 1,465 | 341 | 0 |
| Louisiana | 484 | 520 | 326 | 0 |
| Maine | 65 | 25 | 129 | 0 |
| Maryland | 157 | 869 | 411 | 63 |
| Massachusetts | 92 | 455 | 964 | 0 |
| Michigan | 246 | 756 | 2,590 | 0 |
| Minnesota | 522 | 381 | 593 | 0 |
| Mississippi | 244 | 214 | 290 | 0 |
| Missouri | 1,108 | 1,347 | 998 | 0 |
| Montana | 228 | 118 | 202 | 0 |
| Nebraska | 257 | 278 | 166 | 0 |
| Nevada | 71 | 68 | 152 | 13 |
| New Hampshire | 38 | 76 | 145 | 0 |
| New Jersey | 231 | 979 | 1,030 | 0 |
| New Mexico | 54 | 63 | 93 | 3.7 |
| New York | 543 | 338 | 3,470 | 0 |
| North Carolina | 546 | 576 | 578 | 16 |
| North Dakota | 302 | 103 | 30 | 0 |
| Ohio | 1,040 | 45 | 2,320 | 0 |
| Oklahoma | 388 | 137 | 321 | 0 |
| Oregon | 202 | 124 | 373 | 11 |
| Pennsylvania | 631 | 0 | 976 | 0 |
| Rhode Island | 19 | 16 | 110 | 0 |
| South Carolina | 385 | 1,502 | 414 | 14 |
| South Dakota | 220 | 0 | 45 | 0 |
| Tennessee | 226 | 551 | 735 | 0 |
| Texas | 3,159 | 3,113 | 2,160 | 56 |
| Utah | 68 | 37 | 319 | 39 |
| Vermont | 29 | 29 | 38 | 0 |
| Virginia | 384 | 445 | 487 | 0 |
| Washington | 256 | 675 | 1,610 | 0 |
| West Virginia | 573 | 1,254 | 185 | 0 |
| Wisconsin | 525 | 116 | 638 | 0 |
| Wyoming | 76 | 206 | 48 | 0 |
| Puerto Rico | 82 | 0 | 132 | 0 |
| Virgin Islands | 10 | 2 | 5.8 | 0 |
| Total | 19,591 | 20,675 | 35,300 | 928 |

# TRENDS IN WATER USE, 1950-1990

To facilitate the following discussion of trends in water use, the estimates for some categories used in this report have been combined to correspond to the categories used in previous water-use circulars in this series (public supply, rural use, irrigation, industrial, thermoelectric power, hydroelectric power). Self-supplied domestic withdrawals were combined with livestock withdrawals in this section of the report to compare to the rural use category listed in previous water-use circulars; and self-supplied industrial withdrawals were combined with commercial and mining withdrawals to compare to "other" industries, which were listed with thermoelectric power generation under self-supplied industrial in previous water-use circulars.

Data in table 31 summarize the estimated water use—withdrawals, source of water, reclaimed wastewater, consumptive use, and instream use (hydroelectric power)—at 5-year intervals from 1950 to 1990. Table 31 also shows the percentage increase or decrease in the summarized estimates between 1985 and 1990.

After continual increases in estimates of the Nation's water use from 1950 to 1980, offstream and instream uses were less during 1985 than during 1980. Total offstream use during 1990 was 2 percent more than the 1985 estimate, but still 8 percent less than the 1980 estimate. Instream use during 1990 was 8 percent more than the 1985 estimate, or about the same as the 1975 and 1980 estimates, as shown graphically in figure 33. For most water-use categories, the general slackening in the rate of increase that had been indicated by the estimates compiled for 1975 and 1980 changed to a decrease in water use between 1980 and 1985 (figure 34). Total withdrawals were about 10 percent less during 1985 than during 1980, and the 2 percent increase from 1985 to 1990 is the result of increases in surface- and ground-water withdrawals of 1 and 9 percent, respectively. The fact that the 1990 withdrawal estimates are only slightly higher than the 1985 estimates tends to confirm the overall decline in water use from the peak of 1980.

Two exceptions to this decreasing trend are the "Public supply" and "Thermoelectric power" categories. Withdrawals for both of these categories were about 5 percent more during 1990 than during 1985. The 5-percent increase in public-supply withdrawals corresponds to a 4-percent increase in population served, and the increase in thermoelectric power water use reflects increases in power production.

Total irrigation withdrawals were about the same during 1960 as during 1955, then increased progressively for the years reported from 1965 to 1980. Estimated irrigation withdrawals during 1985 reversed that trend, however, and were 9 percent less than during 1980 and were about the same during 1990 as 1985. The increase in estimated ground-water withdrawals from 1985 to 1990 was partly the result of decreased availability of surface water. Surface-water withdrawals for irrigation increased progressively for the

years reported from 1960 to 1985 and decreased 6 percent from 1985 to 1990. The average amount of water applied per acre for irrigation in the United States during 1985 and 1990 was about 2.7 acre-ft and less than the 2.9 acre-ft applied during 1975 and 1980. The rate of increase in the number of acres irrigated has been decreasing. The acreage reported for 1970 was about 14 percent more than in 1965; for 1975, 8 percent more than for 1970; for 1980, 7 percent more than for 1975; for 1985, about 1 percent less than for 1980; and for 1990, about the same as for 1985.

**Table 31.** ***Trends of estimated water use in the United States, 1950-90.***

[Data for 1950-80 adapted from MacKichan (1951, 1957), MacKichan and Kammerer (1961), Murray (1968), Murray and Reeves (1972, 1977), and Solley and others (1983, 1988). The water-use data are in thousands of million gallons per day and are rounded to two significant figures for 1950-80, and to three significant figures for 1985-90; percentage change is calculated from unrounded numbers]

| | Year | | | | | | | | | Percentage change |
|---|---|---|---|---|---|---|---|---|---|---|
| | [1]1950 | [1]1955 | [2]1960 | [2]1965 | [3]1970 | [4]1975 | [4]1980 | [4]1985 | [4]1990 | 1985-90 |
| Population, in millions | 150.7 | 164.0 | 179.3 | 193.8 | 205.9 | 216.4 | 229.6 | 242.4 | 252.3 | +4 |
| Offstream use: | | | | | | | | | | |
| Total withdrawals | 180 | 240 | 270 | 310 | 370 | 420 | [5]440 | 399 | 408 | +2 |
| Public supply | 14 | 17 | 21 | 24 | 27 | 29 | 34 | 36.5 | 38.5 | +5 |
| Rural domestic and livestock | 3.6 | 3.6 | 3.6 | 4.0 | 4.5 | 4.9 | 5.6 | 7.79 | 7.89 | +1 |
| Irrigation | 89 | 110 | 110 | 120 | 130 | 140 | 150 | 137 | 137 | -.3 |
| Industrial: | | | | | | | | | | |
| Thermoelectric power use | 40 | 72 | 100 | 130 | 170 | 200 | 210 | 187 | 195 | +4 |
| Other industrial use | 37 | 39 | 38 | 46 | 47 | 45 | 45 | 30.5 | 29.9 | -2 |
| Source of water: | | | | | | | | | | |
| Ground: | | | | | | | | | | |
| Fresh | 34 | 47 | 50 | 60 | 68 | 82 | [5]83 | 73.2 | 79.4 | +8 |
| Saline | ([6]) | .6 | .4 | .5 | 1 | 1 | .9 | .652 | 1.22 | +87 |
| Surface: | | | | | | | | | | |
| Fresh | 140 | 180 | 190 | 210 | 250 | 260 | 290 | 265 | 259 | -2 |
| Saline | 10 | 18 | 31 | 43 | 53 | 69 | 71 | 59.6 | 68.2 | +14 |
| Reclaimed wastewater | ([6]) | .2 | .6 | .7 | .5 | .5 | .5 | .579 | .750 | +30 |
| Consumptive use | ([6]) | ([6]) | 61 | 77 | [7]87 | [7]96 | [7]100 | [7]92.3 | [7]94.0 | +2 |
| Instream use: | | | | | | | | | | |
| Hydroelectric power | 1,100 | 1,500 | 2,000 | 2,300 | 2,800 | 3,300 | 3,300 | 3,050 | 3,290 | +8 |

[1]48 States and District of Columbia.
[2]50 States and District of Columbia.
[3]50 States and District of Columbia, and Puerto Rico.
[4]50 States and District of Columbia, Puerto Rico, and Virgin Islands.
[5]Revised
[6]Data not available.
[7]Freshwater only.

To compare self-supplied industrial withdrawals during 1990 with comparable withdrawals for "other" industrial uses during earlier years, the 1990 estimates for industrial withdrawals need to be combined with those for commercial and mining withdrawals. Estimates of total self-supplied withdrawals (fresh, saline) for "other" industrial uses during 1990 were 29,900 Mgal/d, or about 2 percent less than during 1985, which was 34 percent less than during 1980, after remaining about the same during 1970, 1975, and 1980. In fact, self-supplied withdrawals for "other" industrial use during 1990 were the lowest reported in this series since records began in 1950. Surface-water withdrawals for industrial uses during 1990 totaled 21,800 Mgal/d, an 8-percent decrease from 1985; ground-water withdrawals totaled about 8,000 Mgal/d, a 20-percent increase from 1985.

More water continues to be withdrawn for thermoelectric power generation than for any other category, even though about the same quantity of freshwater was withdrawn for this use during 1990 as during 1985 (figure 34). The 4-percent increase in total withdrawals for thermoelectric power from 1985 to 1990 is the result of a 15-percent increase in saline-water withdrawals.

Water used for hydroelectric power generation had been increasing steadily from 1950 to 1975, but, during 1980, it was about the same as during 1975. Water use for hydroelectric power generation during 1985 was 7 percent less than during 1980, and then was 8 percent more during 1990 than during 1985. Changes in hydroelectric power water use are closely related to the availability of surface water.

Even though population increased 4 percent between 1985 and 1990, withdrawal and consumptive-use estimates increased only 2 percent between 1985 and 1990. This is in contrast to 1970 and 1975, when the rate of increase in withdrawals was more than double the rate of population growth.

The trends in water use from 1950 to 1990 can be attributed in part to the following factors:

- Availability of water in a particular year, especially from precipitation and streamflow, strongly affects the quantity of water use for irrigation and hydroelectric power generation.
- Streamflows generally were less plentiful during 1990 than during 1985 because of less precipitation, especially in the West; this increased the dependence on ground water in many areas and the need to irrigate in some areas.
- Withdrawals from the ground-water system can influence the pumping lift, availability, or quality of the water. Each of these factors, in turn, can influence the cost of water and make users, especially irrigators, more selective and efficient in their use of ground water.

- Higher energy prices, improved application techniques, increased competition for water, declines in farm commodity prices, and a downturn in the farm economy in the 1980's reduced demands for irrigation water.
- New technologies requiring less water, improved plant efficiencies, increased water recycling, higher energy prices, the economic slowdown, and changes in laws and regulations to reduce the discharge of pollutants resulted in decreased requirements for industrial water and less water being returned to the natural system after use.
- The enhanced awareness by the general public to water resources and active conservation programs in many States have reduced water demands.

Several agencies and commissions have made projections of national water use to the year 2000 and beyond. The most recent study by the United States Department of Agriculture Forest Service (1989) projects water withdrawals and consumptive use to the year 2040. The projections by these agencies and commissions vary greatly reflecting the availability of reliable data and reflecting different assumptions for future population growth, economic conditions, energy-resources development, and environmental regulations.

Projections of future water use are beyond the scope of this report, although the trends established over the past 40 years provide some basis for estimating future water demands. It seems likely that water withdrawals for public supply and domestic uses will continue to increase as population increases. However, higher water prices and active water conservation programs may reduce the per-capita use rate. With increased competition for water for instream uses, such as river-based recreation, esthetic enjoyment, fish and wildlife habitat, and hydroelectric power, along with higher municipal uses, irrigators will have increasing difficulty competing economically for available water supplies. Municipal and industrial users can afford to pay much more for water than the farmers. Thus, a leveling in the rate of agricultural water use combined with growing population and urbanization suggests that, for the foreseeable future, new balances will have to be struck in water use between the rural and urban areas, especially in the western United States (Moore and others, 1990, p. 97). It seems likely that, for the foreseeable future, industrial water use and use per unit of production will continue to decline in most sectors, although probably not as sharply as in the recent past (David and others, 1990, p. 85).

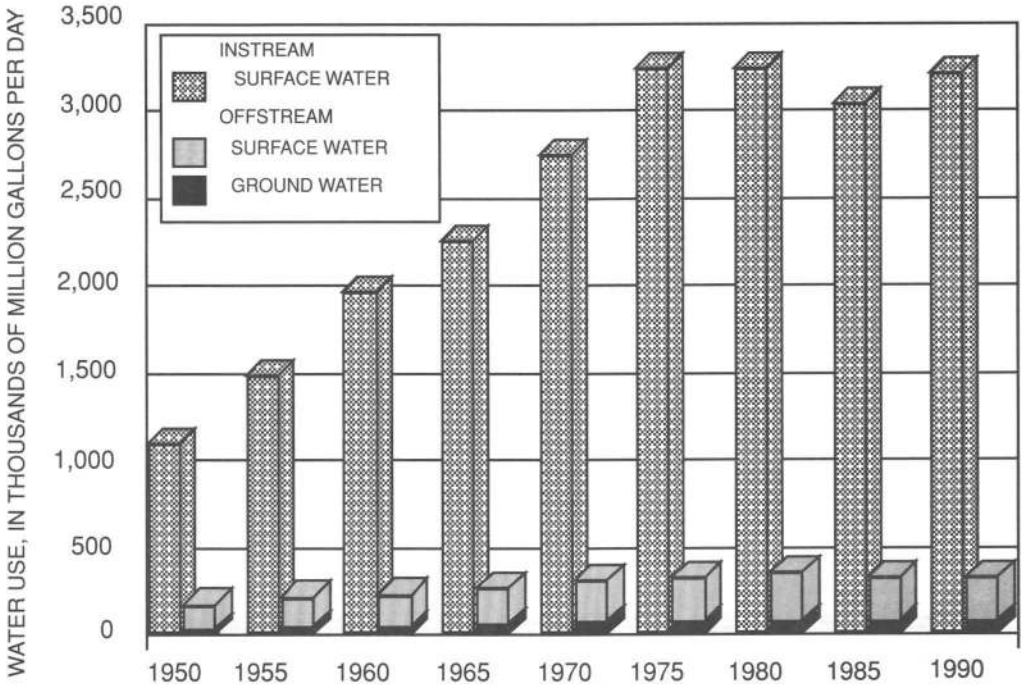



**Figure 33**. Trends in offstream and instream water uses, 1950-90.

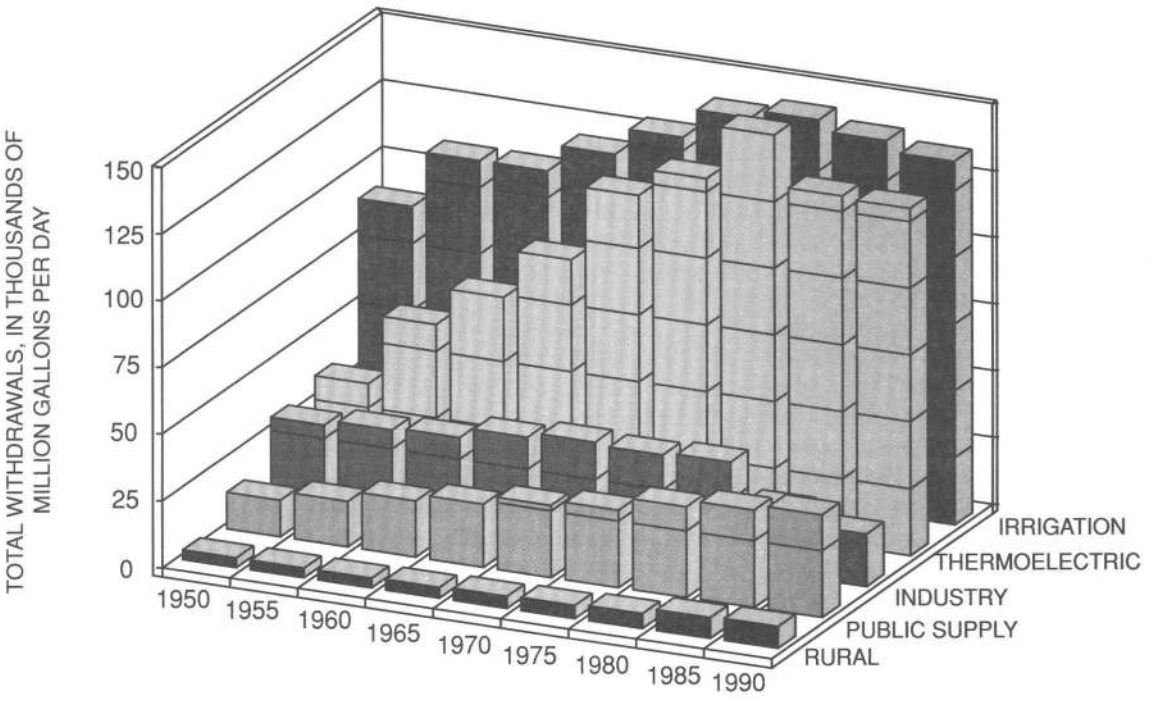



**Figure 34**. Trends in freshwater withdrawals by water-use category for rural, public supply, industry, thermoelectric, and irrigation,1950-90.

Water management in the United States has traditionally focused on manipulating the country's vast supplies of freshwater to meet the needs of users. The effects of this "supply management" approach have been felt in every sector of the economy, from municipal water supply to irrigation. Increasing development costs, capital shortages, government fiscal restraint, less favorable storage reservoir sites, and increasing concern for the environment have forced water managers to begin to rethink traditional approaches to water management and to experiment with new ones. Experts on the subject of western water agree that the West is in transition from the era of water development to an era of water management and conservation (Wilkinson, 1985). Attention now and in the future will be centered on optimizing the use of existing surface-water projects rather than on the further development of large storage reservoirs and major aqueducts, on developing more efficient water application techniques, and on developing other water conservation measures such as lining irrigation canals and installing more efficient plumbing fixtures in homes and office buildings.

Regardless of which projection proves correct, major attention needs to be given to water-management problems to ensure that maximum benefits will be obtained from use of the Nation's water resources. This has become more evident, because, in addition to the need for an adequate water supply, water-quality conditions need to be suitable if supply and demand are to be kept in balance.

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